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ROTUNDA

the magazine of the Royal Ontario Museum

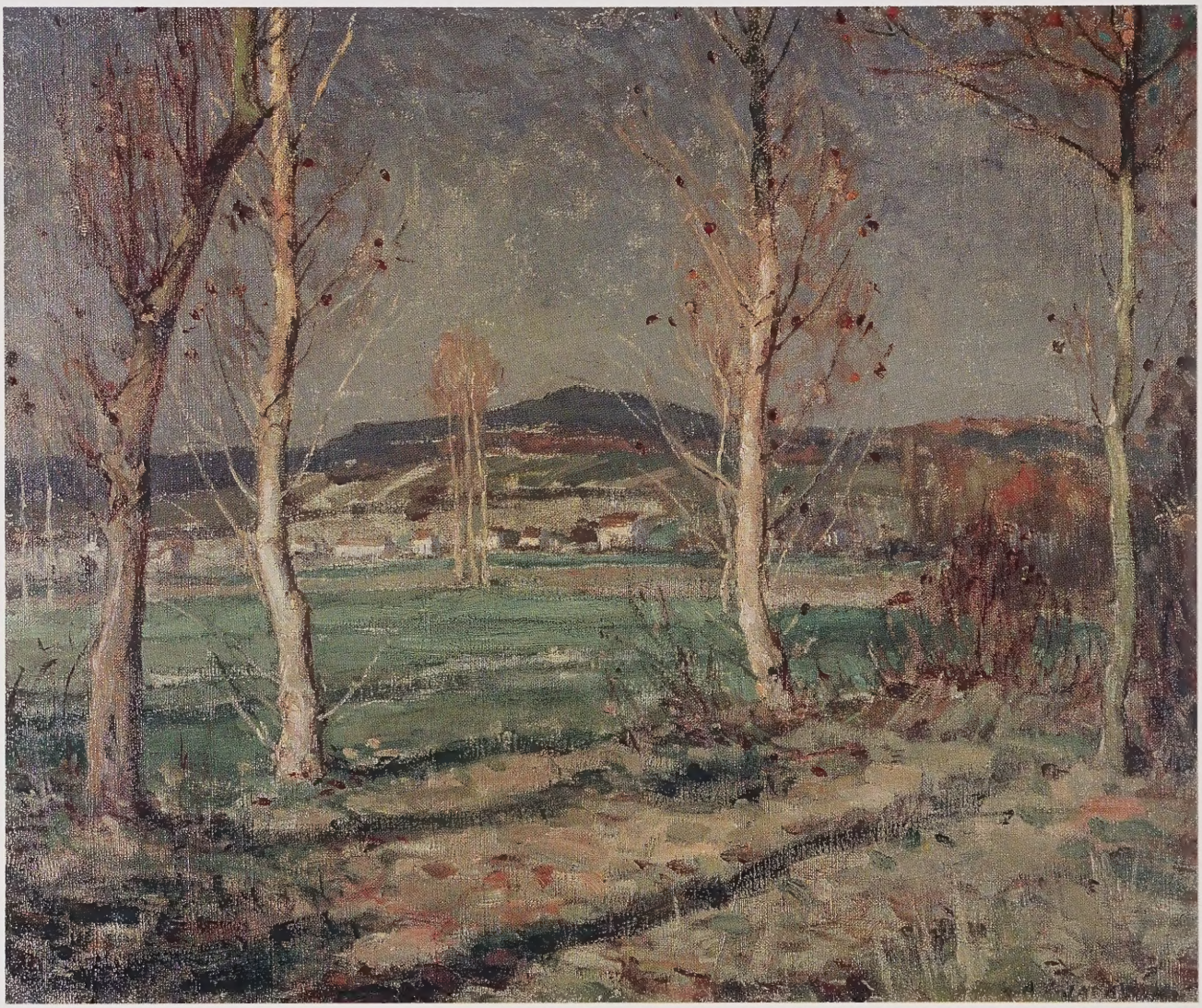
MARKETING AN INDIAN IMAGE

THE MASTER OF THE MESOZOIC

THE ART OF PRINTING TEXTILES

STARS ARE LOOKING YOUNGER

THE GROUP of SEVEN and their contemporaries



A. Y. Jackson: "October Morning, Episy" 1909 o/c 22 x 25 inches

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ROTUNDA

the magazine of the Royal Ontario Museum

Volume 23, Number 1, Summer 1990
(Date of issue: May 1990)

COVER
An old Abenaki canoe carver continues the centuries old tradition of producing handicrafts for the souvenir trade. To find out more about the production of Indian handicrafts turn to page 14.
Photo courtesy American Philosophical Society Library

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EDITOR'S NOTE

As the Great Depression continued into 1937, the Canadian government decided it could offer some constructive assistance to the Indian peoples by serving as a backer to refine and expand the production of reasonably priced handicrafts targetted mainly for the souvenir trade. For centuries, the Indian peoples had successfully produced a great variety of handicrafts for sale beyond their own communities. As a result of the government's plan, the variety of handicrafts decreased, many traditional forms disappeared, and individual expression was lost. The Indian handicraft industry survived the Second World War even though many craftworkers took on more lucrative jobs and materials were difficult to acquire. And as any tourist gift shop will confirm, it continues to flourish, but at what price? In the cover story, Trudy Nicks, associate curator in charge of the ROM's Department of Ethnology, relates the history of the government program and how it has affected Indian culture.

Market demands were also responsible for the development of rapid printing techniques for textiles in 18th and 19th century Europe. Thanks to the talents of former ROM textile curator, Betty Brett, the Museum has one of the world's best collections of European painted and printed textiles. Through the collection at the ROM, her writing, and her assistance to other scholars, Brett has created a legacy. And, in tribute to Brett, who is about to celebrate her 80th birthday, Brigitta Schmedding, a curator in the Museum's Textile Department, has written an article that explains the different painting and printing techniques by using examples from the collection.

In more other worldly spheres than those of handicrafts and textiles, the two science features in this issue deal with research relating to the still major gaps in knowledge about the history of our planet and the origins of the Milky Way. Don Lessem, a contributor to *The Boston Globe*, writes about José Bonaparte, who has been called the Master of the Mesozoic for his research on the unique dinosaur fauna found in South America. The evolution of the fauna adds proof to theories posed by geologists that North and South America were isolated for a period during the Mesozoic epoch.

John Kenny, a Toronto writer, looks at the work of Peter Stetson and Michael Bolte, two scientists at the Dominion Astrophysical Observatory near Victoria, British Columbia, who are sure they have evidence that the Milky Way galaxy did not form all at once as is commonly thought. The result of their research on star clusters not only means that some stars may be several billion years younger than previously believed, it also seriously challenges the so-called sudden collapse theory about the formation of the galaxy, which has been widely accepted for decades. How have Stetson and Bolte come to their conclusions? Believe it or not, it is through the analysis of star light with the most sophisticated computors yet developed.

With stories that range from the entrepreneurial to far out of the world we know, we hope you enjoy this issue of *Rotunda*.

Sandra Shaul

Sandra Shaul

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Leopard *(Felis pardus)* resting in the Masai Mara Game Reserve, Kenya. Photo: Jean-Guy Thibault.

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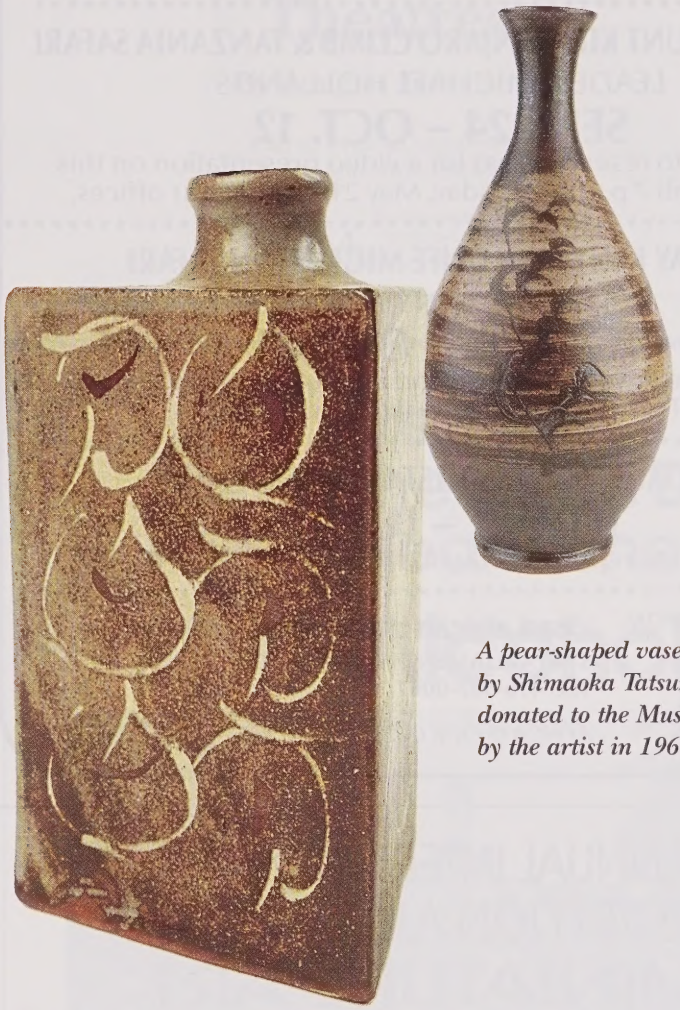
The three-sided pot has an accompanying box inscribed by the potter, Shimaoka Tatsuzō.



PHOTOGRAPHY DEPT., ROYAL ONTARIO MUSEUM

A pear-shaped vase by Shimaoka Tatsuzō was donated to the Museum by the artist in 1966.

Work of Modern Japanese Master added to Far Eastern collections

IN THE MID 1960S, THE POTTER SHImaoka Tatsuzō (b.1919) presented one of his own works, a pear-shaped stoneware vase, to the Far Eastern Department. This was the first gift of modern Japanese ceramics to the department's collection.

Shimaoka's long association with the West, and especially with Canada, began in 1964 when he left the potters' village of Mashiko, located about 90 kilometres north of Tokyo, for an invited trip to the U.S. and Canada to teach and exhibit his works. Since then he has taught or exhibited in Oakville, Waterloo, Montreal, and the Maritimes. In 1982 he visited the ROM's Far Eastern Department collections to see East Asian ceramics from various periods, including his own vase made in the mid-20th century. Now, twenty-five years after the first Shimaoka pot entered the collections, the Museum is fortunate to have acquired a second, thanks to the generosity of Mr. and Mrs. George A. Zuckerman. The contemporary Japanese ceramics collection now includes eleven pieces.

Contemporary Japanese ceramics are well known and collected around the world. They have influenced the work of many Canadian potters. Similarly, contemporary Canadian ceramics are highly regarded in Japan: at a recent competition held in the city of Mino in central Japan, Canadian potters comprised six of the thirty-two award winners selected from 1758 entries from forty-nine countries.

Traditionally, Japanese potters were anonymous artisans who inherited their craft from their forebears. There are several precedents for artist-potters from as early as

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the 16th century, but by and large studio potters, artists known by individual names and distinct styles, are a 20th-century phenomenon. Some of these ceramic artists, however, considered themselves artisan-potters producing utilitarian wares and did not sign their works. Shimaoka's teacher, Hamada Shōji (1894-1978), was one such potter in the folk ware tradition. Hamada worked in England with Bernard Leach (1887-1979), the British potter active in Japan from the 1910s. Hamada returned to Japan in 1924 and established his kiln at the potters' village of Mashiko where traditional folk wares had been produced from the 1850s. Hamada was one of the founders and a major figure in the Folk Craft (*mingei*, literally "art, or craft of the people") movement. The term *mingei* was coined in 1926 in distinction to *bijutsu*, or fine arts. Like the artisan-potters of Mashiko, Hamada did not sign his work, although as the work of the most renowned 20th-century Japanese potter, his pieces are often kept in accompanying boxes which identify the work as his. Many modern Japanese ceramics have fitted wooden storage boxes, which are valued equally with the pots by connoisseurs.

The ROM's new stoneware vessel has an accompanying box inscribed by Shimaoka. The inscription on the lid's interior describes the function of the piece in vague terms but is specific about its decoration: "Three-sided *tsubo* (pot) decorated with an inlaid *karakusa* (arabesque) design; Tatsuzō," followed by a seal impressed in orangish-red reading "Tatsuzō."

The vagueness of the term *tsubo* (pot) suggests several possible uses, most likely as a flower vase for a small floral arrangement or as a flask for serving sake, although pouring liquid from this 19.2 cm high pot would require the use of two hands. Its mottled grey-through-brown glaze is cursorily incised with very stylized *karakusa* (literally, Chinese grasses, a standard

Japanese decorative motif) on all sides. The incised design is painted over with a white slip and an iron brown pigment.

Shimaoka Tatsuzō is the son of an artisan, a rope maker who worked in the city of Tokyo. Shimaoka first came in contact with the *mingei* movement in 1938 and decided to study ceramics, enrolling the next year in the pottery course at Tokyo Industrial University. He first met his future master at Mashiko in 1940 and spent the summer there under Hamada's tutelage. He was formally accepted as a Hamada pupil in 1946; Shimaoka's own kiln in Mashiko was first fired in March 1954.

He eventually became known as Hamada Shōji's leading disciple. The importance of his master to Japanese arts and crafts is undisputed; the Japanese government designated Hamada as an Intangible Cultural Asset (informally, a Living National Treasure) in 1955, specifically for his trailing glazes, and awarded him the Order of Culture in 1968.

After the death of Hamada in 1978, Shimaoka informally succeeded to the leading position among Mashiko potters. There are now more than 150 kilns in Mashiko, and many foreign potters have been attracted there to study.

Shimaoka's aesthetic strength lies in the great variety he achieves within a limited range of glazes and techniques. He is much influenced by the various ceramic traditions of East Asia, in particular by a Korean inlaid-slip decorative technique called *mishima* in Japan. The Museum's earlier Shimaoka acquisition is a traditional Oriental wheel-thrown shape; the newly acquired three-sided flask was formed from slabs of clay. Both pieces have an impressed seal mark on the base: the syllabic *katakana* "ta" of Tatsuzo. These works will be on display in the ROM's From the Collections gallery this summer.

HUGH WYLIE, *Curatorial Assistant*
Far Eastern Department

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An American screwless cork remover.

An early 19th-century English musket tool complete with screw driver and other implements.

A British Henshall-type corkscrew.

A 19th-century Thomason bronze barrel and double-screw lifting mechanism.

PHOTOGRAPHY BY R. MACLEAN

As the Worm Turns

HAVE YOU EVER WONDERED WHAT drives some individuals to collect certain objects with the dogged determination of a salmon heading upstream to spawn? One of the most unusual collectibles I have encountered is the corkscrew. So serious are the collectors of this item, formerly called a bottle scrue, that three associations have been formed by those who have the habit. The International Correspondence of Corkscrew Addicts started by Dr. Bernard M. Watney, FSA, in London, in 1974, limits its worldwide membership to fifty. An applicant wishing to join when a space becomes available is carefully screened with regard to the extent of his collection and the degree of his devotion to the study of the topic. The Canadian Corkscrew Collectors Club, founded in 1981, now has seventy-eight members from the U.S.A., Canada, Britain, and Italy, many of whom dream of joining the "fabled fifty" and a few of whom have already achieved that magnificent goal. A third group, the Italian Association of Corkscrew Collectors, was founded in December 1988, in Milan. It is not uncommon for members of these groups to have assembled personal collections comprising more than a thousand antique corkscrews.

What is it about the corkscrew that enthralls scholars, engineers, doctors, and businessmen alike and draws them together from all over the world to discuss, to trade, and to admire? Many explanations have been given to me: the mechanical intricacies, the diversity of styles, the aesthetics of design, the historical interest, the portability. Underlying all these justifications there is also the irresistible lure of discovery, because research on these fascinating objects is still extremely limited. The guru of the Canadian Corkscrew Collectors Club, Ron MacLean, cautions, "Every statement about corkscrews should contain the words 'possible' or 'probable'."

Although the corkscrew is now almost exclusively associated with wine, it was probably used originally to get at the popular home brews of beer and cider. Nobody knows who actually invented it, but the idea of a "steel worm used for the drawing of corks out of bottles" is thought to have originated from an instrument used for drawing unfired bullets and wadding out of firearms. The bottle scrue became

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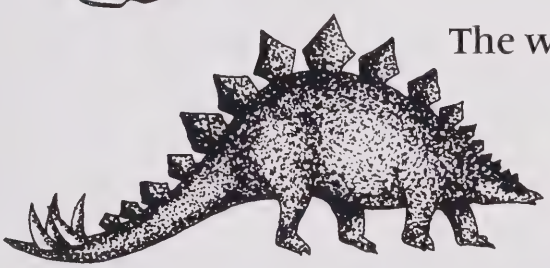

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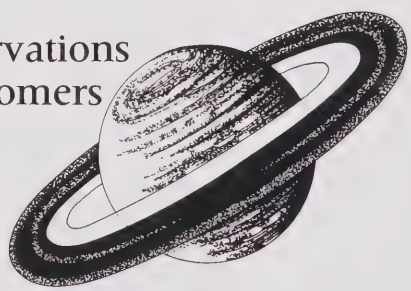

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more of a necessity with the advent of strong glass bottles in the 1630s. Previously, bottles were used only for transporting liquids from a barrel to the table and were made from leather, tin, stoneware, pewter, wood, or delicate glass. With the new verre anglaise made stronger by firing in the higher temperatures of coal fires, storage of liquids in bottles became more practical. Stoppers such as twists of cloth, leather, tapered wooden plugs tied on with string, and glass stoppers ground to fit individual bottle necks could not compete with the ideal qualities of cork. Gradually bottles of all sizes, containing everything from medicines and perfumes to cleaning fluids, as well as alcoholic beverages, were stoppered with impermeable corks that required considerable force to extract.

Although mentioned in print as early as 1681, the first recorded patent for a corkscrew was granted to a London clergyman, Samuel Henshall, in 1795. Since then hundreds of different corkscrews have been invented, making use of the modern technology of the day and reflecting the prevalent artistic fashions. The basic corkscrew is a simple instrument of three parts: a handle, a shank, and a worm or screw. The worm is inserted into the cork by turning the handle and extraction takes place by pulling upwards. It is the worm that is the most important variable. Of the eight basic designs the helical worm is the most highly recommended. Great variations in size, shape, and materials can be found in the handles, from ornate to sturdy. Artisans worked with bone, different kinds of horn, steel, wood, brass, silver, and plastic. Decorations and materials are now helpful in identifying the age, origin, and quality of old pieces.

Often secondary implements were incorporated with the corkscrew, such as pipe prickers and tampers, nutmeg graters, personal seals, cutlery, toilet necessities, work tools, keys, and nutcrackers. In the late 18th century, many corkscrews had a brush inserted in one end to dust off the labels and tops of bottles that had been stored away in cellars. Spikes and knives, included in the 19th century to cut wires and break away wax coatings, are now equally useful for cutting space-age plastics. However, the champagne tap, invented to enable a person to draw off just what was required, in case of sickness, while the remainder stayed fresh in the bottle, has become obsolete. The medicinal qualities of champagne are so renowned that rarely does a bottle go unfinished, and if by chance it does, modern bottle stoppers will preserve the sparkle for another day.

In 1802 an important advance was made in corkscrew design

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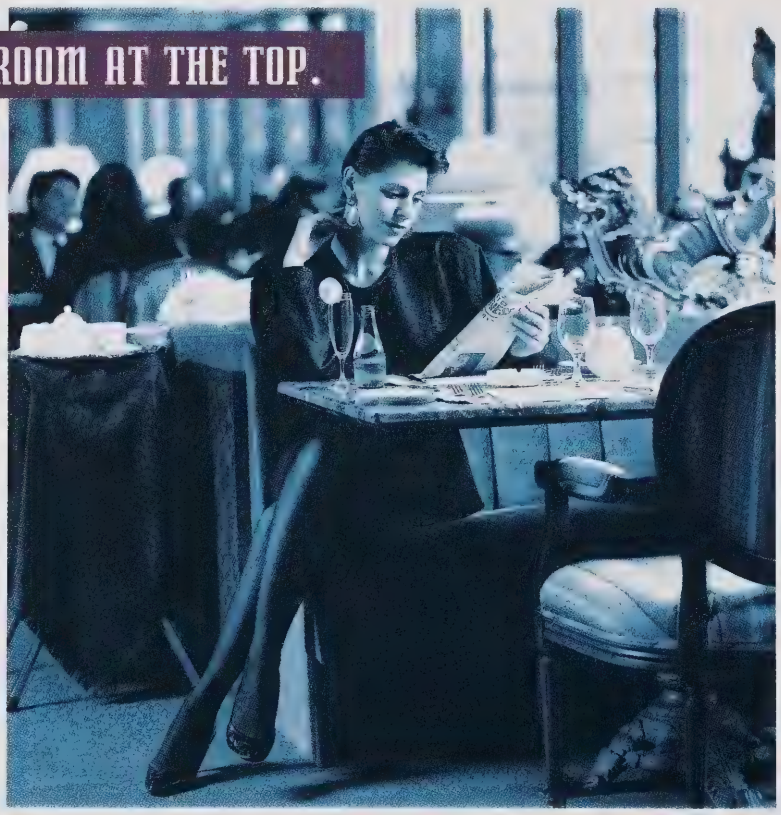

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when a patent was granted to Edward Thomason, a Birmingham industrialist. Because of the continuous action of the screw, which reversed and drew the cork into a barrel that fitted on top of the bottle, a very small amount of physical exertion was required. Later in the 1800s there were many patents employing lever actions, such as Lund's Lever (1855), and some of them were so awkward to use that one can only guess at the supposed improvement initiated by the design. Nevertheless, the lever mechanisms did lead to the universal sommelier's tool that is hauled out of every waiter's pocket whenever wine is ordered in a restaurant. As public houses and saloons became increasingly popular gathering places, a specific bar corkscrew was invented that would be sturdy and efficient, and require little muscle power so that even a young lad or a female could operate it effortlessly on a busy night.

Another design in the late 1900s became known as the "Butler's Friend" (now called the "Ah So"). With its screwless, two-pronged frame, corks could be extracted without piercing, thus making it possible to remove good wine, replace it with wine of inferior quality, and re-stopper the bottle with the cork.

Far easier for the collector to handle are the numerous pocket corkscrews that were produced. They offer a multitude of different features: picnic screws, in which the worm is sheathed, with the sheath, in some cases, doubling as a handle; the folding bow or harp teamed up with any number of tools such as a button-hook, awl, screwdriver or punch; the roundlet with a barrel shape into which the worm folds up; and tiny, dainty corkscrews meant for the lady's purse or chatelaine's hook to be used for medicine and perfume. Corkscrews were also incorporated in watch chains, walking sticks, umbrellas, and whips. Added to the variety of materials used and diversity

of designs are the different origins: English, French, German, Dutch, and American. All these variables make for a never-ending search for the one piece that no other addict has found.

Corkscrew collectors are a devoted lot and the following story is a favourite taken from the earliest printed account of a bottle screw, written by Ned Ward, a London tavern keeper, and published in 1700, in *The London Spy*. The story describes a dinner with two country parsons and a Quaker.

At last we came to a good-looking ....bottle of claret, which at least held half a pint extraordinary, but the cork was drove in so far that there was no opening it without a bottlescrew. Several attempted with their thumbs to remove the stubborn obstacle, but no one could effect the difficult undertaking; upon which the donor of the feast exclaimed: "What, is nobody amongst us so provident a toper as to carry a bottlescrew about him?" ...The oldest and wisest of the parsons, having observed the copious dimensions of the bottle and well knowing by experience that sound corking is always an advantage to good liquor, says, "I believe I may have a little engine in my pocket that may unlock the difficulty," and fumbling in his pockets, after he had picked out a common prayer-book, an old comb-case full of notes, a two-penny nutmeg grater, and made a great move of such kind worldly necessaries, at last he came to the matter, and out he brings a bottlescrew, which provoked not a little laughter throughout the whole company. "Methinks, friend," says the Quaker, "that a common prayer-book and a bottlescrew are improper companions, not fit to lodge in the pocket together. Why dost thou not make thy breeches afford them separate compartments?" To which the parson made answer: "Since devotion gives comfort to the soul and wine in moderation preserves the health of the body, why not a book that instructs in the one and an instrument that makes way for the other, allowed as well as the soul and body to bear one another company?"

GERALDINE RUBINO *is a Toronto-based freelance writer on wine.*

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INDIAN HANDICRAFTS: THE MARKETING OF AN IMAGE

The mass production of handicrafts has conditioned the public image of Indians

TRUDY NICKS

THROUGHOUT THE GREAT DEPRESSION, THE ANNUAL relief paid to Canadian Indian communities by the federal government kept mounting until in 1937-38 it reached more than $1 million. Clearly this was an untenable situation; ways had to be found to help the Indian people support themselves. And so in 1937, the Indian Affairs Branch of the Department of Mines and Resources created the Welfare and Training Division. Under the supervision of R. A. Hoey, a former Manitoba education minister, the Welfare and Training Division initiated programs of vocational training and offered assistance to trapping and agricultural enterprises. It also developed a marketing program for Indian handicraft work, which continued into the 1960s. The records of the division from the 1930s and 1940s, now housed in the National Archives of Canada in Ottawa, reveal the organization of the handicraft program, what effects it

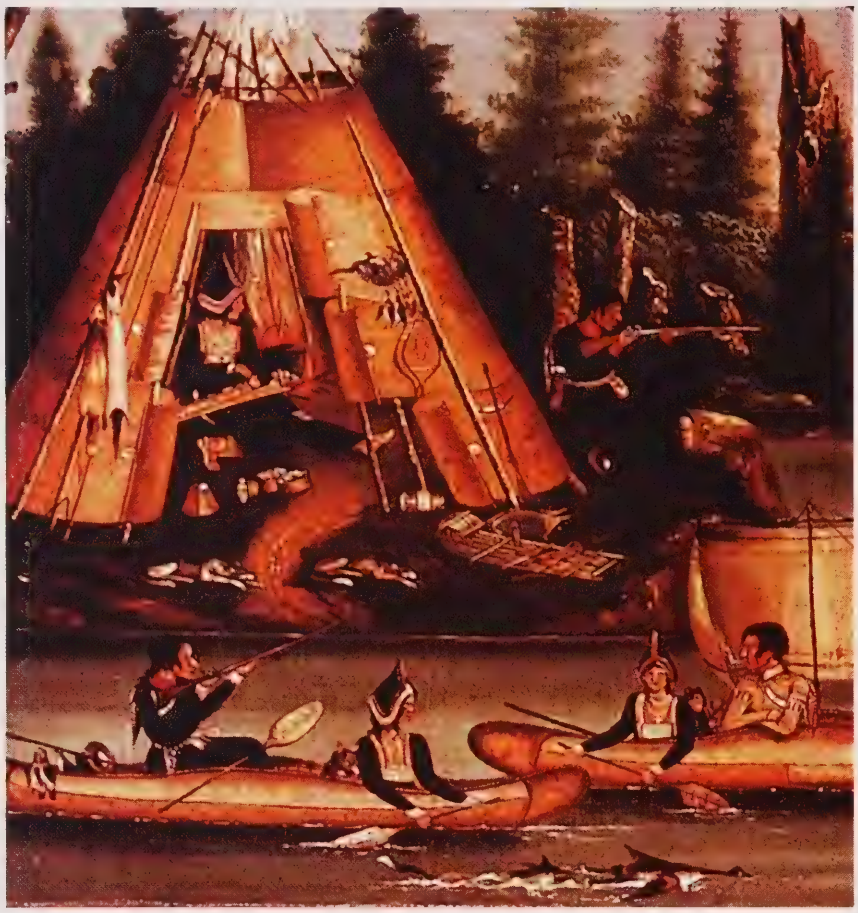
PHOTOGRAPHY DEPT., ROYAL ONTARIO MUSEUM

Dr. Trudy Nicks is associate curator-in-charge of the Department of Ethnology, Royal Ontario Museum.

had on the economy, and how it influenced the designs of handicrafts and generated a greater awareness of Indian culture.

Since the main objective of the handicraft program was to provide economic relief, emphasis was placed on developing non-traditional as well as traditional crafts that would be readily marketable. Commercial production was of prime importance; the preservation of arts and crafts for their cultural or historical significance was not even a consideration.

In this detail from the painting *Micmac Indians* (c.1820-1830, anon.), in the collection of the National Gallery of Canada, Ottawa, there are baskets near the woman in the wigwam that are similar to the three baskets on the facing page.
Facing page: Three 20th-century birch bark baskets show the standard design set by the agent from Christian Island; all three are in the collection of the Royal Ontario Museum, the bottom two were donated to the province of Ontario in 1927 by George Edward Laidlaw.



NATIONAL GALLERY OF CANADA, OTTAWA

Officials at the division first looked for traditional handicrafts that they felt were marketable. For centuries Indians of southern Ontario and Quebec had been producing baskets for sale and these became a mainstay in the Welfare and Training Division stock.

Burned leatherwork and metalwork were introduced as new crafts. Handloom weaving was another, using looms from the Guild of All Arts in Toronto and patterns purchased from The Structo Manufacturing Company of Freeport, Illinois (which also supplied the Native Industries Centre in Caracas, Venezuela). A willow plantation was established in the 1940s on the Ojibwa reserve at Muncey, in southern Ontario, as a job creation scheme. Willow could be grown and sold as a raw material, and used to manufacture baskets and furniture. This project failed, however, because the willow planted was not the best type for craftwork, and the ini-

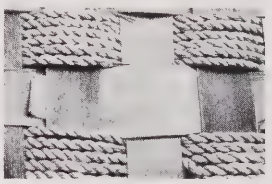
tiative for the project came entirely from department officials in Ottawa rather than from the community.

Ottawa assisted Indian craftworkers to buy and ship raw materials when local supplies were exhausted. Black ash logs were obtained for the manufacture of splint baskets and birch and maple logs were sent to communities that made tool handles. Ottawa coordinated the distribution of sweet grass, porcupine quills, birch bark, and tanned hides. The hides were often tanned by commercial rather than native tanners in part because people purchasing souvenirs didn't care for the smell of smoke-tanned leather. Other commercial materials provided for craftwork included dyes, beads, reeds, rattan, and Hong Kong grass. The Government lent its assistance, and craftworkers were expected to repay the government for the costs of the materials from the proceeds of their handicraft sales. Materials could cost as much as twenty per cent of gross sales.

The success of the government's program to make Indian communities self-supporting during the Depression and then World War II depended to a great extent on the craftworkers' ability to assure a steady supply of popular items with standard designs

Records of the Welfare and Training Division from the 1930s and 1940s include long inventories of utilitarian and novelty craft items. More than half of the inventory at any one time consisted of different styles and sizes of baskets, mats, trays, bags, and boxes made of ash splints, sweet grass, and birch bark. There were many wooden souvenirs, such as carved figures, cups that hooked over belts, paddles, knives, pipes, tomahawks, bows and arrows, war clubs, tie racks, and totem poles. Birch bark photograph frames and napkin rings, model tepees and canoes, sewing accessories, and lapel pins; beadwork items, such as belts, moccasins, gloves, and necklaces; burned leather work; and loom-woven scarves; bags, ties, sashes, afghans, bassinette blankets, "and other useful pieces of work" are recorded too.

Staff of the Welfare and Training Division also advised on ways to modify designs and techniques in order to save production time. That is why a standard pattern and colour scheme for beadwork appeared on dozens of pairs of moccasins ordered from Golden Lake, Ontario. Because British Columbia Indians could not produce model totem poles as cheaply as the Japanese, orders were placed with Indians in eastern Canada who could. Since 1939, when Ottawa placed the first orders for totem poles, the Ojibwa of Ontario have become major suppliers of totem poles to the tourist souvenir industry.



Not only did production costs have to be reduced so that the crafts produced on Indian reserves in the 1930s could compete with foreign imports from Japan, the United States, and Germany, the costs also had to be low enough so that the final retail price would appeal to tourists with limited funds. Retailers applied price mark-ups of at least fifty per cent, yet to be marketable, souvenirs had to retail for less than one dollar. To survive, the craftworkers had to assure a steady supply of popular items with standard designs, colours, sizes, and quality.

Most of the advice and assistance came from Kathleen Moodie, the division's first fieldworker. She corresponded with Indian communities across Canada, visiting many in Ontario and Quebec. Indians were hired

to teach traditional crafts in their own communities and to others, which is how Émile Paul, a Huron from Loretteville near Quebec City, came to work at a canoe factory on a reserve near Fort William (present-day Thunder Bay) in 1937-38.

Ottawa developed a number of marketing strategies for Indian crafts. For years the division succeeded with major displays at the Canadian National Exhibition in Toronto: the 1941 exhibit realized sales of $5300 in a year when most visitors, according to reports, "were of a

The 1830s version of Cornelius Krieghoff's painting *Woman Going to Market,* in the collection of the Royal Ontario Museum (gift of Dr. A. W. Conn), shows that the making and marketing of handicrafts is a longstanding Indian tradition. Facing page: Tools set with metal teeth are used to cut wooden splints into narrow strips of uniform length. The strips are left with their natural colour or dyed and then woven, often with cord, to make baskets.

PHOTOGRAPHY DEPT., ROYAL ONTARIO MUSEUM

class who were interested in cheap souvenirs rather than in the better and higher priced items."

Craft exhibits and sales at other fairs, such as the annual Lakehead Exhibition, were also supported. In the late 1930s and early 1940s an Indian "village" of six to ten birch bark "wigwams" was set up at each fair. Local Indian people, who produced snowshoes, full-sized canoes, woven rabbit skin blankets, and a range of other crafts, would inhabit the village display. In addition to sales made during the fair, craft producers usually received orders for later delivery.

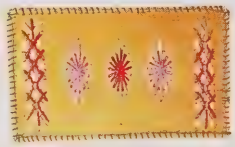
Contracts from retail outlets were also pursued. Sample displays were taken to Winnipeg in 1939 and 1941, which were aimed directly at buyers for Eaton's and the Hudson's Bay Company stores. Some government departments made bulk purchases: in 1938 the Royal Canadian Mounted Police purchased heavy loom-

woven scarves made at Caughnawaga (Kahnawake) for the men who worked on police cutters on the Atlantic coast.

Distribution to British Columbia and the prairie provinces from the major producers in Ontario and Quebec was arranged with the assistance of the National Parks Branch of the Department of Mines and Resources. Crafts available through the Welfare and Training Division's warehouse in Ottawa were displayed in the various National Parks' western headquarters. Price lists permitted local merchants to place orders for stock directly with Ottawa. No matter where it was actually produced, craftwork could be customized with the name of a community or resort.

In their efforts to make mass production more efficient, the marketing schemes initiated by the federal government greatly reduced the regional and individual diversity of handicrafts by favouring standardized items

In 1939 the division requested permission to set up a display of handicrafts in the House of Commons so that Members of Parliament could learn about the program and then, hopefully, offer their support. Dr. Arthur Beauchesne, the Clerk of the House, said that no space was available in the House of Commons for Indian handicraft exhibits, but suggested that there might be a better chance in the Senate.



By the early 1940s the division was using commercial companies in Toronto and Winnipeg to market and distribute Indian handicrafts. In 1942 tags shaped like maple leaves were first attached to crafts as an assurance to buyers that the items were made by Indians and had been inspected by officials in Ottawa.

Was the Welfare and Training Division handicraft program really effective? Selling handicrafts was certainly not a new activity for the Canadian Indian people, who had been producing utilitarian and novelty crafts for sale in towns and at tourist resorts long before Ottawa's involvement. Likewise, Ottawa was not the first to take on the role of middleman in the sale of those handicrafts. Companies such as C. N. Saba & Co. of Toronto had been in that business since the early part of the 20th century. From Ottawa's standpoint the program simply adopted a proven system to alleviate the load of economic relief.

On the other hand the program provided Indians with a large scale and efficient alternative to selling crafts directly or dealing with private companies such as Saba. Newly learned crafts sometimes led to jobs in industry. Such was the case for several girls from Caughnawaga who, in 1940, found employment at the Forsyth factory in Kitchener as a result of their training as weavers.

For a number of reasons, the program did not have the same impact across Canada. Only a few reserve communities in Ontario and Quebec actually became major production centres for the Ottawa distribution system. These included St. Regis (Akwesasne), Caughnawaga (Kahnawake), Odanak near Pierreville, Golden Lake, and Christian Island near Georgian Bay. The division never had sufficient staff or travel funds to encourage handicraft projects at reserves in other areas. Logistical considerations in getting stock to Ottawa for inspection

PHOTOGRAPHY DEPT., ROYAL ONTARIO MUSEUM

and in filling orders on short notice made it too difficult to deal with communities that were a great distance from the Ottawa warehouse. The division also argued that whereas handicrafts were the only possible source of income for many reserves in Ontario and Quebec, reserves in other parts of the country could develop agricultural and resource industries.

During the 1930s and 1940s, the income that Indian communities realized from handicraft production amounted to a few thousand dollars annually. In 1938,

An Abenaki basket maker was photographed at the Odanak Reserve near Pierreville (near Montreal) in 1923. Facing page, top to bottom: A birch bark cover from an autograph book produced on the Rama Reserve, Ontario, c. 1950. An Ojibwa birch bark container produced in the early 20th century has a scraped design. The paper shortage during World War II made woven wood splint shopper baskets very popular. The three artifacts are in the collection of the Royal Ontario Museum, the last donated by K. E. Kidd.

PHOTOGRAPH COURTESY OF THE AMERICAN PHILOSOPHICAL SOCIETY LIBRARY, PHILADELPHIA

for example, fifteen families at Odanak made a net income of $5900 from basketry and woodwork. Payment was on a piecework basis. In the 1940s, a dozen quill-decorated, birch bark napkin holders were worth sixty cents; depending on size, fully quilled round boxes were worth $3.60 to $12.00 per dozen; and plain woven sweet grass sewing baskets were worth $1.60 to $5.00 per dozen. However, by 1942 Ottawa was able to report that more than five thousand Indians "otherwise unemployable" had been taken off relief as a result of opportunities available through the handicraft program.

World War II affected the handicraft program in several ways. Japanese and German crafts no longer competed with Canadian crafts. Because paper products were at a premium during the war years, the market for shopping bags woven of ash splints soared. Unfortunately, about a third of the line of goods in pro-

duction at the beginning of the war had to be discontinued as the men and women who made the handicrafts entered the armed services or went to work in munitions factories, where a much better income could be earned.

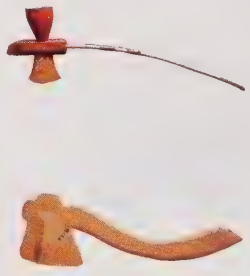
Imported materials used for crafts became difficult or impossible to obtain. Government limitations on imports during wartime very much affected the Huron at Loretteville, Quebec, who manufactured moccasins made of upholstery leather ends imported from the United States. Indians across the country who used glass beads for decorative work faced similar restrictions. In 1943 it took four months of memo- and letter-writing by the Welfare and Training Division to get clearance from the Department of Customs and Excise for the importation of glass beads from the United States. The process was complicated because beads were classed as a nonessential luxury item, and the supply available in the United States had been made in Czechoslovakia, a country then under German occupation. Furthermore, by the time the various fees and special wartime taxes had been applied to the shipment, the cost of beads had more than tripled, making them virtually unaffordable to the craftworkers.

The Ottawa-initiated handicrafts with their standard and limited designs represent not a loss but a survival of Indian cultures because they created a broad public awareness of the distinct identity of the Indian people in Canada

In their efforts to make mass production more efficient, the marketing schemes initiated by Ottawa greatly reduced the regional and individual diversity of handicrafts in favour of standardized items. Craft-production supervisors ordered samples of stock items from the Ottawa warehouse and used these, along with the photographic catalogue put out by the division, as models for their craftworkers. A typical situation existed at Christian Island Reserve, where the local Indian agent and craft supervisor, K. A. Cowan, was very specific when he gave the following instructions to his workers in 1942: *Quillwork is preferable in animals, maple leaves, plants, birds, and in emblems of Canada—mostly in natural colours occasionally tipped with red or soft colours as yellow, blue and soft purple.*

Such designs were used earlier and in areas other than Georgian Bay. Cowan's instructions turned an existing aesthetic into a set of rules. Regional distinctions also disappeared. It was was not unusual for pieces made in Ontario to be customized for sale as souvenirs of Jasper and other resorts. These standardized handicrafts reinforced a stereotyped and generalized public perception of "Indian" material culture, which remains even today.

Yet many of the artifacts produced under the Welfare and Training Division handicraft program have now found their way into museum collections along with the more traditional examples of Indian material culture. The handicrafts are valuable sources of information about the ways in which Canadian Indian people have responded to the changing world of the 20th century. The Ottawa-initiated handicrafts represent not a loss but a survival of Indian cultures, and they have helped to preserve a public awareness of Indian people as having an identity, which is distinct from other Canadians.



The two wooden tomahawks, one shaped as a pipe and both non-functional, are souvenirs of Midland, Ontario in a private collection.

PHOTOGRAPHY DEPT., ROYAL ONTARIO MUSEUM

José Bonaparte, Master of the Mesozoic

New evidence proves that distinct and often bizarre-looking dinosaurs evolved in South America

Don Lessem

PHOTOGRAPHY BY PAUL SERENO

The great dinosaur hunters, like gun-toting Roy Chapman Andrews of the American Museum of Natural History, have been larger-than-life figures. José Bonaparte of the Buenos Aires Museum should be included in their ranks—he is described as "the Master of the Mesozoic, the greatest dinosaur hunter alive," by Robert Bakker, one of the best-known and most radical dinosaur palaeontologists of our time. Yet when peering at fossils in museum basements, where he spends most of his time, José Bonaparte doesn't look the part of the intrepid fossil explorer. He is a man of modest proportions, about sixty years of age, with large glasses and a balding pate. His polished manners, neat attire, and scholarly parlance suggest his academic side.

"Modest" is a word Bonaparte himself often uses to characterize his life. "My life style and my whole family is modest, without money, but," he adds, "we work strong." Only the last statement suggests the dedication, the physical stamina, and the firm leadership of a man who has walked the Argentine wilderness every summer for decades and, in so doing, has almost single-handedly changed the worldview of Mesozoic South American life.

No country, with the possible exception of China and the United States, has produced such a broad sampling of dinosaurs as Argentina. And it is Bonaparte who is chiefly responsible for filling in the yawning gap in knowledge about the species of South American animals that survived over 150 million years—and filling it with unexpectedly bizarre creatures.

Some of the great fossil-finders were said to possess a sixth sense for finding fossils. Neither Bonaparte nor his colleagues claim that he himself has such a gift; rather, they suggest he has made his finds by dint of curiosity and determination. Paul Sereno, a colleague based at the University of Chicago,

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Don Lessem is a frequent contributor to The Boston Globe.

Bonaparte led Paul Sereno and eight associates into the stark badlands of northwestern Argentina, two hours' drive from the nearest town

says, "He works exceedingly hard. He is incessantly in pursuit of fossils."

In 1988 Sereno joined Bonaparte in pursuit of more complete remains of perhaps the oldest dinosaur, a fierce predator named *Herrerasaurus*. Four-toed and unusually short in the thigh for a dinosaur, *Herrerasaurus* was evidently a savage and highly mobile predator, more than a metre long and weighing at least as much as a linebacker. Its antiquity and its location make it the nearest well-known dinosaur descendant of *Lagosuchus*, a smaller reptilian with a nearly dinosaurian ankle, also explored by Bonaparte.

Bits of *Herrerasaurus* had been excavated before by Bonaparte and other Argentineans, but never the most diagnostic of parts, the skull. Bonaparte led Sereno and eight associates into the stark badlands of northwestern Argentina, two hours' drive from the nearest town.

Here at the foot of the Andes they came to an enormous barren depression running north-south and strewn with sandstone towers, mesas, and huge rust-red lumps of ironstone. This forbidding land is named on tourist maps the Valle de La Luna (Moon Valley); more properly it is the Ischigualasto Valley, a refuge for the wildlife of the region—guanaco, rheas, armadillos.

Bordering the valley to the east is a nearly two-kilometre-high wall of cliffs. It was the most spectacular terrain Sereno had ever seen—snow-capped mountains in the distance, and around him shapes and colours to "equal the Painted Desert" of the American West and escarpments that made "the Flaming Cliffs of Mongolia look like mere ridges."

To Bonaparte and Sereno, the greatest appeal of Ischigualasto was its nearness to another world, the world of the first dinosaurs. The sediments of this valley belong to the Ischigualasto Formation, some 220 million years old, and to two even older Triassic formations. The variegated exposures of Ischigualasto age are 80 kilometres long and 274 metres thick and are full of fossils. The site is one of the longest continuous stretches of Triassic time open to examination anywhere on Earth.

The forbidding landscape of the Ischigualasto Valley has earned it the name Valle de La Luna (Moon Valley) on tourist maps.

At Ischigualasto Bonaparte, Sereno, and the Argentine-North American crew found fossils galore. Bonaparte stayed only three days and then was off for other digs, but Sereno soon found what Bonaparte was certain he would. "I laid my pack on a prominent rocky spine and walked off 15 metres, straight to the most complete early dinosaur skeleton and the first herrerasaur skull ever discovered. I screamed." Preparation and analysis of the skull and the articulated shoulder and limb bones to which it was still linked have yet to be completed, but Sereno is confident the discovery will answer many questions about early dinosaur evolution.

Bonaparte was far calmer about the find. But then he had been working Ischigualasto for twenty-five years, and admits, "I was confident we would find something." And Bonaparte has witnessed far stranger fossil-finding events in Ischigualasto and across Argentina. In 1964 Bonaparte and Jim Jensen, then a Harvard preparator, joined a crew from Harvard. When the crew finished its weeks of work near Ischigualasto, its fossils were confiscated by jealous provincial authorities. This was the first and only known instance of fossils being placed in jail. (Jensen did escape with one truckload in a chase he describes as "something out of a TV thriller, crossing high mountain roads with hairpin turns and boulders flying down on us, pursued by armed groups.") With quiet diplomacy, Bonaparte and colleagues negotiated the return of the remaining fossils to Harvard. And for his own museum, Bonaparte subsequently amassed from the area a collection of fossils superior to Harvard's.

The man often considered the most accomplished dinosaur-digger of our time was digging dinosaurs before he had been formally schooled in palaeontology. And ironically, to this day, he does not have any particular interest in dinosaurs.

Bonaparte's path to professional success has been neither straightforward nor easy. He grew up in Mercedes, an Argentinean city 100 kilometres from Buenos Aires. Florentisco Ameghino, who with his broth-

er Carlos pioneered dinosaur palaeontology in Argentina in the late 19th century, had taught grade school there as a young man and collected Ice-Age fossils from the river nearby. An elderly and retired fossil collector from the La Plata Museum, Don Andres Canessa, lived in Mercedes when Bonaparte was a boy. He showed the youth fossils he had dug up and kept in his own yard. Bonaparte was sixteen and impressionable. "This man gave me my first thought to collect fossils."

Though his family was hard-pressed for space and income, Bonaparte's mother tolerated his interest, allowing him to pile fossil bones in the halls of their house. He travelled to Buenos Aires, studied the Ameghinos' collections at the museum, and read from their twenty-two-volume survey of Argentine palaeontology. "They are our heroes," he says reverentially.

As the Ameghinos had done, Bonaparte intended to concentrate on fossil mammals. Without any formal palaeontological education he founded a museum with other boys in Mercedes and published scientific papers. Because it was mounted in a Socialist meeting hall, the museum was shut down when the Peron government came to power. Bonaparte was allowed, under police supervision, to work nights studying and building the collection, after his daytime labours were done. Years of struggle were rewarded when the museum was given a new home in the city's main library, where it is still located.

In 1959, University of Tucuman officials invited him to become keeper of their collection. In his spare time he also audited classes. Alfred Romer, the great Harvard University mammal palaeontologist, met Bonaparte at Tucuman during a 1968 visit. Impressed with young Bonaparte's dedication, Romer invited him to Harvard that year and again in 1973. It was not until 1974, after fifteen years in the university's employ, that Bonaparte received an honorary doctorate from his employer and the rank of titular professor of palaeozoology. The next year the National Geographic Society began funding his digs, modest but vital support that has continued annually to the present. And in 1979 the Buenos Aires Museum invited him to reorganize its old and ruined vertebrate palaeontology division.

PHOTOGRAPHY BY PAUL SERENO

Bonaparte has been there since, based in a large and aged office, now as its head of vertebrate palaeontology. He leads a

It was Bonaparte who finally documented the peculiar South American fauna that evolved during the continent's isolation

thriving if impoverished intellectual community—eight young assistants at present, three of them with doctorates in Mesozoic animals.

Two of Bonaparte's children are grown—a son is a computer programmer and a daughter is an agronomic engineer. But his teenaged son Juan José still accompanies him on the unchanging routine of his summers: "two months of enjoyment and suffering" in the remote Argentine wilderness, a field season divided among four sites, some of them new prospects, others established digs. His wife, Reyna, does the cooking for the eight- to twelve-man crews. At times the conditions are luxurious. More often they are harsh. In 1988 even the indomitable Bonaparte was turned back by the conditions at a Late Cretaceous dinosaur fossil locality above the huge glacial Lake Argentino in Patagonia. "It took us most of the day to get up there by horse but the wind and cold made it impossible to work. The horses reared up and nearly threw us."

220,000,000 years ago
Anisian
(Late Triassic)

140,000,000 years ago
Tithonian
(Late Jurassic)

80,000,000 years ago
Santonian
(Late Cretaceous)

Such disappointments are rare in Bonaparte's fossil-collecting career, even if he does keep running into huge, bizarre dinosaurs in his search for tiny mammal skulls. But then, Bonaparte has been finding spectacularly distinctive and well-preserved dinosaurs across Argentina from the entire Mesozoic era, for more than thirty years. Herrerasaurs and their near-contemporaries from Ischigualasto are but the earliest of what have proved to be a truly astonishing array of dinosaurs.

As described by Bonaparte and his coworkers, these fossils present a portrait of dinosaur forms often quite distinct from those known from the rest of the world. Bonaparte has done far more than excavate and catalogue this distinctive fauna; he has always attempted to place it into a larger context, analyzing its implications for dinosaur behaviour and evolution and world palaeogeography.

During the Mesozoic era, North and South America were isolated for millions of years. A distinct fauna (facing page) evolved in South America.

According to Bonaparte and to earlier theorists on continental formation, the ancient southern super-continent of Gondwanaland was isolated during most of the Mesozoic. However, the work of previous palaeontologists had only vaguely suggested how the separation might have affected South America's dinosaur fauna. It was Bonaparte who documented this isolation through his finds of dinosaur fossils belonging to peculiarly or principally Gondwanan lineages—armoured, plant-eating giants called titanosaurs, short-limbed predators called abelisaurids, the huge, vegetarian dicraeosaurids and the sail-finned spinosaurids, and several endemic forms of crocodiles, birds, and mammals, all absent from the northern continent of Laurasia.

Bonaparte's finds run the entire gamut of the Mesozoic, beginning in the Triassic, before South America and its nascent dinosaurs went their own way. Some of the most spectacular of these are tiny.

Bonaparte and a University of Tucuman preparator, Martin Vince, announced in 1979 that they had found the world's first known nest of Triassic dinosaurs. Bonaparte and Vince made their discovery in the Santa Cruz province of southern Patagonia. The area has been explored by Bonaparte and others repeatedly since, and has produced many adult dinosaurs very similar in form to the first prosauropods, a worldwide line of bipedal plant-eating dinosaurs well known from European quarries.

When Bonaparte and Vince began looking at the site in 1976 it was to examine a big concretion, a mineral ball nearly 2.5 metres around, that had broken open. They saw it was "full of small animals," as Bonaparte recalls. What they found within were the smallest dinosaur skeletons yet known, nine in all and none larger than Bonaparte's cupped hands, and two intact eggs, each smaller than a golf ball. Stretched out, the babies measured but 20 centimetres, though Bonaparte reckons they might have grown to 3 metres. Honouring the fossil's diminutive stature, Bonaparte and Vince named the new-

found genus *Mussaurus* (mouse lizard).

Bonaparte also found late Triassic dinosaurs more than 200 million years old in the uppermost red beds of the 800-metre-thick Los Colorados Formation that sits above Ischigualasto in La Rioja province. Some of the Ischigualasto animals appear to have survived at least early into the time period represented by the sediments deposited in the Los Colorados. But tucked into the top sheets of the bed where Bonaparte looked is an entirely different group of animals, large prosauropod dinosaurs included. The biggest animal Bonaparte named *Riojasaurus*, a plant-eater perhaps 11 metres long, which lumbered on four solid-bone legs. Below it, but from the same environment, he found the skull and jaws of a slender bipedal prosauropod, which he called *Coloradia brevis*.

Bonaparte also came up, a decade ago, with the first known assemblage of dinosaurs from the South American Jurassic (190 million to 135 million years ago). These animals he found in fossil beds some 15 million years older than the well-known dinosaur-producing sediments of Tanzania and Colorado. Not unexpectedly, the sauropods and predator Bonaparte uncovered were more primitive than those two similar faunas. The predator, of which Bonaparte turned up almost every bone but those of the foot and hand, resembled the big, familiar *Allosaurus* of the Morrison Formation in Alberta but was longer in the arms and less complicated in the pelvis (lacking a well-developed "foot" to the pubis).

As for the new sauropods, one, a 4.25-metre-long *Patagosaurus*, had several spinal similarities to an English sauropod *Cetiosaurus*, but differed in the shape of a pelvic bone and in the spines on some higher vertebrae. Bonaparte found several incomplete individuals of it and of a still more primitive giant herbivore. Overall, however, the close, perhaps ancestral, relationship between these finds and later Jurassic finds in North America and Africa suggested to Bonaparte, as he wrote in *Science*, that "a terrestrial fauna interchange was possible between South America and other continents."

By the Cretaceous, however, Gondwana and its inhabitants were isolated. Palaeontologists who knew their palaeogeography suspected that evolutionary change within the isolated gene pool of southern continental dinosaurs over mil-

1. Spinosaurus
2. Diplodocus
3. Argyrosaurus

Bonaparte revealed a striking example of a distinctive South American dinosaur with the discovery of a nearly complete *Carnotaurus*

lions of years had led to a highly distinctive fauna. Such isolation accounts for the distinctive modern animals of islands such as Madagascar and Australia. Until Bonaparte's finds, however, there was precious little evidence for applying this to South American dinosaurs.

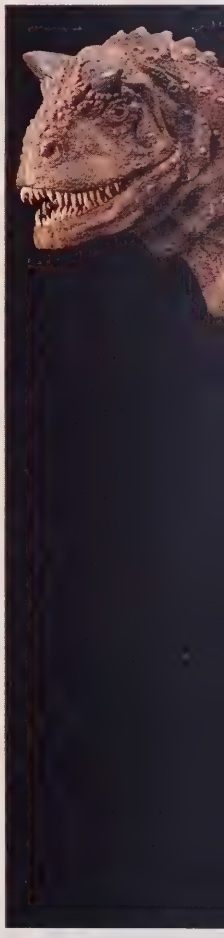
The Gondwana predatory dinosaurs were especially mysterious. Bonaparte and his student Jaime Powell began clearing the air with *Noasaurus* (northwestern Argentina lizard), a little predator they described in 1980 from fragmentary remains. Less than 3 metres long, it sported "terrible" claws sharper than those of its North American, Late Cretaceous contemporary, *Deinonychus*. However, unlike the other big-clawed small dinosaurs of Asia and North America, *Deinonychus* included, the noasaur had its claw attached to a muscle, which flexed it by a pitted notch, not a raised knob. Though only a small detail on a partial small skeleton, it was enough to convince Bonaparte and other palaeontologists that the noasaurs came upon their slashing claws by a quite separate, if parallel, evolutionary path from *Deinonychus*.

DRAWINGS BY JOHN SIBBICK

Five years later Bonaparte revealed a far more complete and striking example of how South American dinosaurs evolved distinctive features in geographic isolation. A Patagonian rancher, Angel Sastre, told local geologists (who informed Bonaparte) of parts of a foot and the tail of a huge dinosaur skeleton he had seen protruding from a cliffside in badlands a hike away from his *estanzia* in Chubut Province (not far from where Bonaparte had found Jurassic dinosaurs). Sastre hadn't bothered to excavate the fossils, though he suspected an entire dinosaur lay within the cliff. "It was in very hard concretion," explains Bonaparte, "a very big headache to get out." Bonaparte went to inspect, and soon to dig. With hammer and long stick, Bonaparte separated fossil from matrix. By wheelbarrow he pulled the nearly complete skull and much of the body of a huge dinosaur from the cliff. He described it the next year, 1985, as *Carnotaurus* (the meat-eating bull).

Some 7.63 metres long, *Carnotaurus* was nearly as imposing as its North American counterparts, *Albertosaurus* and *Tyrannosaurus rex*. But *Carnotaurus* was in many details nothing like them. The skull was blocky, short, and narrow. Large horns extended menacingly from above the eyes. The forelimbs were far shorter even than those of *Tyrannosaurus rex* but the hindlimbs were proportionately longer and slimmer. "It's very strange," says Bakker, admiringly. "It surprised me how different it and other South American dinosaurs are. It seems South America was quite a bit an island in the Cretaceous."

In the same year, Bonaparte and his student Novas described a skull from the Late Cretaceous belonging to a dinosaur they named *Abelisaurus* (after the man who found it in northern Patagonia, Roberto Abel, an Argentinean museum director). This predator was the size of *Carnotaurus*, but with a longer skull, made light and probably highly mobile by large holes behind the eye. Thickened nasal bones and a deep jaw lent the animal what newsletter-writer, and palaeontologist-manqué, Olshevsky described as "a distinct Roman nose."



Different as the horned bulldog faces of *Carnotaurus* and the hook-nosed countenance of *Abelisaurus* might appear, the animals have several features in common, including a small opening above and behind the eyes. So Bonaparte put them both in the new fami-

Top: Lagosuchus was a small reptilian with a nearly dinosaurian ankle. Bottom: Herrerasaurus is the oldest known dinosaur. Far right: Carnotaurus.

ly, the Abelisaurids. Distinctive as the abelisaurids are, Bonaparte does see a distant ancestor for them in *Ceratosaurus*, a dinosaur found in the Late Jurassic of North America. A contemporary of *Allosaurus*, it is similar in many features, from big head to puny arms to stout legs.

The sauropods of North America, the giant plant-eaters that were the biggest land animals ever known, seem to have disappeared by the Early Cretaceous, more than 100 million years ago, to be replaced by the duckbill dinosaurs. However, throughout Argentina, as Bonaparte and his co-workers have found, the sauropods not only persisted, but were the dominant browsers until the end of the dinosaur fauna on that continent. One group of sauropods, the titanosaurs, were especially fond of life in Gondwanaland.

ARTIST'S CONCEPTION BY STEPHEN CZERKAS

Titanosaurids (giant lizards) are the largest family of sauropods, known from Africa, India, China, and Europe, in the Cretaceous. They have small-brained heads that are characteristically wide, their jaws lined with peg teeth; but the heads were so fragile and are so little preserved that Bonaparte's titanosaur finds are commonly referred to as "headless wonders." Their front legs outstretch the rear pair by a fourth. They finish with long whip tails. Bulky and likely lumbering, titanosaurs were universally big, however, not all were truly titanic in size; fully grown, they appear to have ranged from 9 to 31 metres long. During the spring of 1989 in Neuquen Province, Bonaparte found a few bones of a huge Late Cretaceous titanosaur, as yet unnamed, which he believes from its vertebrae—1.5 metres high and 1.2 metres wide—to be the largest sauropod known from South America.

Titanosaurs were first described in South America in 1893, but they were not well known until recently when Bonaparte found and identified four South American sub-families of titanosaurs from the Cretaceous. Among his discoveries was the first known armoured titanosaur, *Saltasaurus*. He and Powell excavated fos-

While there is much to be learned from South American dinosaurs, the geological history of southern South America offers no clues to the dinosaurs' extinction

sils of the creatures in Salta Province of northwest Argentina, and reported their find in 1980.

With the scattered bones of several saltasaurs, Bonaparte and Powell found two types of armour—large oval plates splashed across the skin and a crowded layer of round or pointy bony studs on the back and flanks. Bonaparte found other titanosaurs, some fully armoured, others patchily shielded with grapefruit-sized skin plates he calls "ossified leather." Armoured titanosaurs have also turned up in Spain. But nowhere do they appear to have dwelt in such numbers and diversity as in South America.

Why? The evolution of armour may help to explain the success of the titanosaurs over other plant-eating dinosaurs in South America. Or "perhaps it was the climate," Bonaparte speculates. "The environment was perhaps drier in South America and not to the duckbills' liking." Yet on the whole, Mesozoic mid-latitude lands like Argentina appear to have been relatively wetter than those at similar latitudes in North America. Possible slower development of flowering plants in the southern hemisphere would also explain why sauropods retained their dominance there.

The relation of the South American titanosaurs to each other, to other titanosaurs in the world, and to the entire sauropod line remains vague, complicated by the absence of skulls on the South American specimens. "It's impossible to decide what pieces compare to what; it makes interesting work."

Among Bonaparte's still little-known dinosaur finds is one from 1984 whose name is not yet official (a scientific description is at press). The animal is a very odd sauropod with tremendously outsized neural spines that stick upwards, like a punk rocker's mane, from its neck vertebrae. It hails from the Early Cretaceous of northern Patagonia but its closest relative is the *Dicraeosaurus* from the Late Jurassic of Tanzania in what is now the distant continent of Africa. Many of Bonaparte's colleagues have seen drawings of the creature. All are discreetly reserving detailed comment until Bonaparte formally announces the find. The spinal mane is even more dramatic evidence than the singular form of *Carnotaurus* that South American dinosaurs detoured sharply in an evolutionary direction of their own when physically and genetically isolated from their North American cousins.

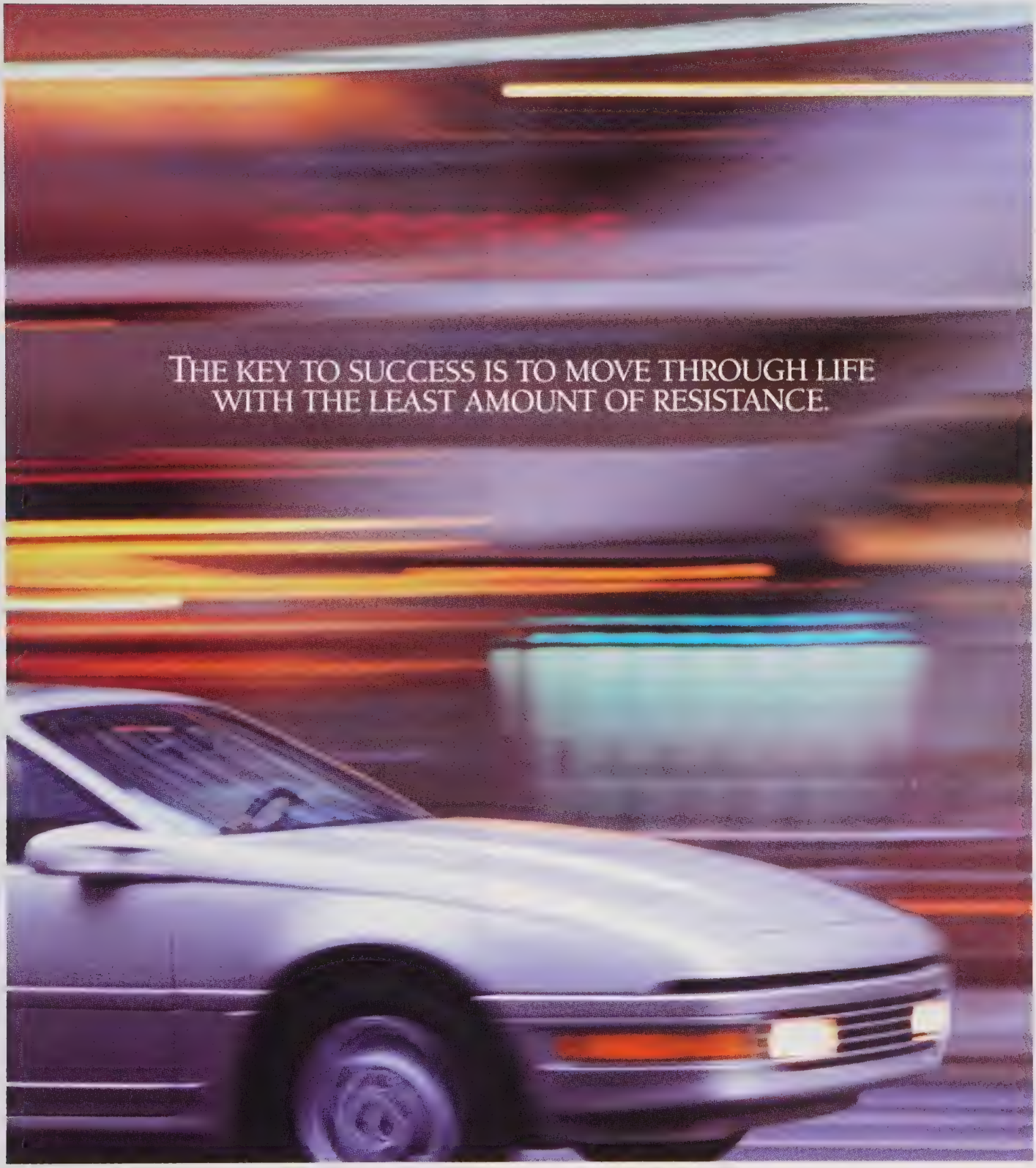
Bonaparte discovered spectacular remains of another sauropod in early 1988, from the early Late Cretaceous of Neuquen Province. "We've got complete specimens, skull to tail, of a new family of sauropods. One has a complete set of gastric stones. Each of the seven stones is about 10 centimetres in diameter."

The continents of North and South America rejoined near the end of dinosaur days, thus explaining another of Bonaparte's remarkable finds — the remains of twenty-five individual duckbills in a one-kilometre area of Patagonia. The reunification of the two Americas allowed a mixing of dinosaur faunas. Some duckbills, though not enough to replace titanosaurs as the ruling herbivores, penetrated right through South America. According to a recent find by one of Bonaparte's Argentine colleagues, the armoured anklyosaurs of North America expanded their range all the way through South America to Antarctica.

The exchange was not one way, as Bonaparte reasons. Some South American sauropods, namely *Alamosaurus*, were able to make it at least as far north as Utah before a harsher climate, change in vegetation, or competition and predation stopped their march. It was a slow migration, Bonaparte stresses, achieved by individual movement and herd expansion of territory, which continued for generation after generation.

While there is much to be learned yet from South American dinosaurs, including clues to the continent's geological history, Bonaparte asserts, the geological history of southern South America offers no clues to the dinosaurs' extinction. "In the last Cretaceous epoch," says Bonaparte, "Patagonia was all under water."

Bonaparte aims to continue digging fossils for several more years, "to continue the Ameghinos work. I study what I find in Argentina," he says. "If it is dinosaurs, so be it."



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Betty Brett: A Life in Paint and Print

Betty Brett has created a legacy for those who love painted and printed textiles

Brigitta Schmedding

In the 21 August 1970 edition of the *Times Literary Supplement*, *Origins of Chintz* by Katherine Brett and John Irwin was described as "almost a model of what can be achieved in the history of the Indo-European decorative arts." This glowing review describes only one of the major achievements in the remarkable career of Betty Brett, a former textile curator at the Royal Ontario Museum, who extensively researched and documented Indian chintz and European printed fabrics. How her career evolved is the story of a perfect match of her training as an artist with her interests and a sequence of events at the Museum.

After graduating from the Ontario College of Art in 1931, Brett worked both as a commercial and as an exhibiting fine artist. In 1937 she travelled to England to attend a three-week course in colour lino-cut printing at the London School of Arts and Crafts. Her teacher, John Farleigh, assigned her a textile project. She produced a piece of muslin printed all over with the figure of a young dancing girl holding a bouquet of flowers. It is now in the ROM's collection, where it serves as an excellent example of textile printing as it was taught in the 1930s.

In 1938 Brett began work as a draughtsman with the Cataloguing Department of the Royal Ontario Museum of Archaeology, and in 1942, because of her interest in printing techniques, she was put in charge of the rotat-

In September 1977, Betty Brett and Georges Estrad
the opening of the exhibition *French 18th-Centu*

Brigitta Schmedding is a curator in the Textile Department, Royal Ontario Museum.

hen French consul-general, joined others to celebrate
rinted Textiles at the Royal Ontario Museum.

PHOTOGRAPHY DEPT., ROYAL ONTARIO MUSEUM

ing exhibitions of European prints and drawings. Brett took a leave of absence in 1943 to serve in Europe. When she returned to the Museum in 1945, she joined the staff of the Textile Department.

While familiarizing herself with the department's holdings she discovered the Indian chintzes; it was love at first sight. The quality of the free hand painting attracted her artistic mind and eye and she started to study the designs and the technique of these fabrics in depth. John Irwin, keeper of the chintzes in the Indian section of the Victoria and Albert Museum, had been studying chintzes from the aspect of the East India trade. Brett and Irwin joined forces and the results were *Origins of Chintz*, their *catalogue raisonné* of the two great museums' chintz collections, and major exhibitions of the fabrics in Toronto and London in 1970.

Chintzes are cotton fabrics, produced in India for the European market, patterned in colourful and usually floral designs through a combination of hand painting and dyeing. Brett and Irwin's research showed that the "oriental" designs, which were the craze in Europe throughout the 17th and 18th centuries, were derived from sample patterns from Holland, England, and France that were sent to India for manufacture. It was the execution of these patterns by the Indian cotton painters that gave the finished fabrics the exotic air. Europeans attempted to start their own production of colourful and washable fabrics by block-printing. They eventually succeeded in the late 17th century.

Approximately sixty of the Indian chintzes owned by the ROM were collected by Harry Wearne, a designer of printed textiles. Wearne's collection of historic textiles included eight hundred items that were mainly printed, displaying almost all techniques and decorative styles from the 18th and 19th centuries. They served as inspirations for his own designs. It was the pieces from this collection that not only sparked Brett's interest in chintzes but also her research on block-printing.

In the late 1960s and early 1970s, with help from the Canada Council, Brett travelled widely to study the holdings of museums in Europe, especially in France and Switzerland, and in the United States. She quickly gained a reputation as one of the world's top authorities in the field of French 18th-century printed fabrics. This reputation probably made her instrumental in the founding of a museum in Jouy-en-Josas near Versailles.

Christophe-Philippe Oberkampf, the most famous textile printer of 18th-century France, had founded a factory to manufacture printed textiles in Jouy. Brett visited the town in order to research some of the documents related to textile production. At a dinner with local authorities, Betty voiced her dismay about the lack of a museum. The mayor spearheaded the efforts to correct that situation, and in 1977 twenty-two printed Jouy textiles from the ROM were sent as loans to the inaugural exhibition of the Musée Oberkampf.

This was not the only time that painted and printed cottons from the ROM's collection travelled across the

Betty Brett produced this piece of printed muslin as a student in London. It is now in the collection of the ROM.

PHOTOGRAPHY DEPT. ROYAL ONTARIO MUSEUM

Atlantic for exhibition. Through her research on chintz Brett met Paul R. Schwartz, director of the Musée de l'Impression sur Étoffes in Mulhouse, another scholar conducting pioneer research on the technique. For a Canadian Week organized for Mulhouse in 1966, Schwartz wanted the ROM represented by a selection from the textile collection. He preferred fabrics from the Wearne collection because of their quality and because Wearne's career really began in Mulhouse. So Brett sent a selection of fabrics that gave an overview of the whole Wearne collection.

Throughout her years as a curator at the ROM, Betty Brett continued to collect all types of painted and printed fabrics in order to enhance and broaden the holdings that had initially come to the Museum through the Wearne donation. Often these additions had to be purchased, which meant that for some items Brett had to search for donors. Because of the respect that she had gained through her reputation there was usually someone willing to help. However, money was not the only hurdle when it came to acquisitions.

In 1956 the Cooper Union Museum in New York had an exhibition of painted and printed textiles, which included a valance made from an Indian painted and dyed fabric decorated with a beautiful big pineapple. What delighted Brett was the fact that the ROM had a French printed 18th-century cotton in the collection with exactly the same motif. She wrote a letter to Miss Elinor Merrell in New York, the lender, to ask if she happened to have any scraps of the same fabric for sale, or if she could at least supply a photograph of the valance and give Brett permission to publish it. Miss Merrell never wrote, but one day Brett received a telephone message that there was an American visitor for her at the Museum's main entrance.

The visitor was Miss Merrell, who is still one of the world's most important dealers and collectors of painted and printed textiles. A friendship began that endured for decades, and many textiles changed hands, that is, with the exception of the pineapple valance. Betty Brett retired in 1975. Eight years later, John Vollmer, curator of the ROM's Textile Department and one of the organizers of the exhibition *Silk Roads—China Ships*, asked to borrow the valance for this exhibition. The loan was approved, the show travelled for two years, and Miss Merrell finally donated the valance.

Betty Brett also became a well-known authority on costume through numerous exhibitions and publications. From the mid-1950s, she collaborated closely with the Toronto chapter of Fashion Group, an association which continues today, and made the Royal Ontario Museum the first museum in North America to collect 20th-century couture dresses.

On 26 June 1990 Betty Brett will celebrate her 80th birthday, and what a rich life she has to look back on. The contributions she made to the Museum and to the understanding of painted and printed fabrics are a wonderful legacy for those who love textiles.

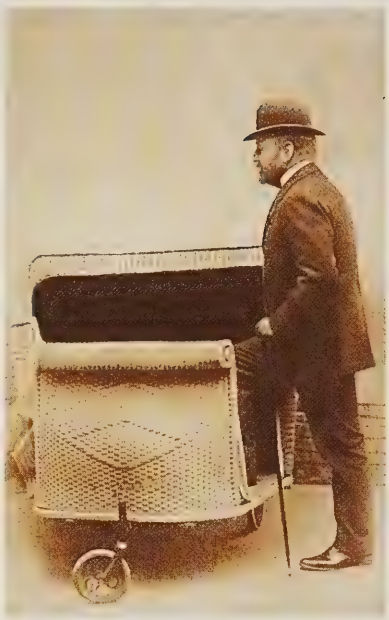
Harry Wearne and his Collection

THE HARRY WEARNE COLLECTION OF TEXTILES WAS SO highly regarded that thirty-four items from it were included in the Metropolitan Museum of Art's *Retrospective Exhibition of Painted and Printed Fabrics* in 1927. Wearne's widow donated the collection to the Royal Ontario Museum of Archaeology "almost out of the blue sky," as the Museum's first director, Charles T. Currelly, had put it in a letter to the Board of Trustees dated 6 September 1934. To his knowledge, no one at the Museum had ever been connected to Mr. Wearne. Speculation has it that Wearne's widow made the donation in response to a very kind and appreciative letter that Currelly had written to thank her for the gift of a book received earlier that year. The book contained sixty-three reproductions of Wearne's designs and was published by his wife and daughter after his death in 1929. Currelly was very much aware of the significance of the collection and "extremely grateful" for its donation. The combination of increasing values for such textiles and limited funds at the Museum had made it "impossible to buy much in the way of textiles." In fact, the Wearne Collection became the basis for textile collecting at the Museum.

Harry Wearne was born in England in 1852. As a young man he travelled to France where he joined the famous wallpaper factory of Zuber & Cie, located in Rixheim near Mulhouse. He began work as a designer and later became a manager with that company, and even married one of the Zuber daughters. Because of the German occupation during World War I, Wearne moved to the United States where he established himself as a designer of high-class furnishing fabrics for the American market. His designs were hand block-printed in Cummersdale, England, by Stead McAlpin & Co. After the war, Wearne made frequent trips to France to buy antique printed fabrics.

Shortly after the Wearne collection was donated to the Museum, a textile designed by Wearne was donated by an upholstery and drapery fabrics store in New York. During Brett's curatorship three more pieces of his furnishing fabrics were donated to the Textile Department. When the British printing firm closed its block printing section in 1977, the ROM also received two sets of woodblocks engraved with Wearne designs.

One of the sets, which had been used to print a landscape with pheasants, comprises 196 engraved blocks that had to be placed in exact locations on the cloth, which is 178 cm wide, in order to compose the whole image in its many colours. The picture is one of a series of four panels depicting landscapes with a variety of birds and plants that Wearne created at the end of his life. He considered them his legacy as an artist. When he died in 1929, only the first panel had actually been engraved into the wooden blocks, a task that took more than a year to complete. Blocks for the remaining three panels were never made.



PHOTOGRAPHY DEPT., ROYAL ONTARIO MUSEUM

Above: Harry Wearne in 1909.
Below: Wearne designed this furnishing fabric.

PHOTOGRAPHY DEPT., ROYAL ONTARIO MUSEUM

A selection of printed and painted fabrics

The textile collections of the Royal Ontario Museum contain a variety of painted and printed fabrics. Several different techniques are used to decorate fabrics, and some of them are explained on the following pages.

Indian Chintz

The front of this quilt (231 x 142 cm) is constructed from a palampore (bedcover), which was made in India for the European market in the first half of the 18th century. The fantastic flowering tree was a favourite pattern for this kind of textile. The quilt was purchased in the Netherlands for the ROM by Betty Brett.

Europeans trying to create their own chintz had to discover how the Indian craftworkers produced fabrics with lively colours that did not run or fade in water but rather became even more brilliant through repeated washing, something unheard of in the West. The solution was to apply mordants to the cotton fabric followed by a dyeing process. Mordants are chemical solutions that make the cotton fibre receptive in different ways to natural dye stuffs. A variety of mordants were used in varying strengths and mixtures. In the eastern parts of India, the mordants were brushed like paints onto the fabric. A fabric treated this way and then dipped into one dyebath of a red colour would emerge from the bath showing the painted areas in different shades of red, violet, brown, and black. Many more steps were needed to create the blue, yellow, and green areas of a pattern. The preparation of the cloth before patterning and finishing it afterwards were also very time-consuming and labour-intensive processes.

Indiennes

The striped cotton fabric of this valance was printed in seven colours using four sets of blocks by a factory (active between 1172 and 1820) in St-Denis, France, according to the stamp on the reverse side. The style of the exotic flowers is a direct imitation of the splendid floral decoration of Indian chintzes. That is why such French fabrics were called indiennes. The Harry Wearne Collection, gift of Mrs. Harry Wearne.

In Europe mordants were applied to the cloth with wooden blocks, which had patterns carved in relief. A different block was needed for each colour. Because a block could only be as large as one man could handle, sometimes large patterns had to be broken down into two, three, and even four rectangular sections and then separate sets of blocks made for each section. Even though European textiles were always printed in factories, in the beginning, all procedures were carried out by hand. To embellish the prints, many young women were hired for the specific task of "pencilling" in with a brush the direct dyestuffs, such as yellow, that were only needed in a few spots on the pattern. To create blue in the patterns of the Indian chintzes, all areas that were not to be blue had to be covered with a resist and then the whole textile was dipped in a vat of indigo. Europeans eventually found a faster method whereby the indigo dyestuff could be kept dissolved for the time that it took for it to leave a brush onto the textile, where it immediately oxidized.

PHOTOGRAPHY DEPT., ROYAL ONTARIO MUSEUM

Toiles de Jouy

The pattern of this furnishing fabric, produced in the Jouy factory, is an allegorical representation of the four continents. The design was created by the factory's chief designer, Jean-Baptiste Huet, about 1785. The Harry Wearne Collection, gift of Mrs. Harry Wearne.

The method of applying mordants to fabric with copper plates was first tried by an Irishman in the 1750s. After being introduced in England, this intaglio technique then travelled to France where the most famous cotton printer, Christophe-Philippe Oberkampf, began printing fabrics at Jouy in 1759. So famous were his printed scenes of human figures that they became known as the "toiles de Jouy." The patterns, which cover about a square metre, are usually composed of several scenes, each set on its own "island." A whole pattern could be engraved into the surface of a copper plate with very fine lines. The mordant filled the grooves on the plate and then was conveyed onto the surface of the cloth through the application of pressure by a machine. Although this process was much faster than block printing, and enabled a much finer design with shading, only one colour could be used because it was too difficult to correctly register a second plate in order to align new detail with that already printed.

Roller Printing

The subject of the line engraved print, which is taken from the novel* Paul et Virginie *by Bernardin de Saint-Pierre, was designed by Huet and printed at the Oberkampf factory about 1802.

The Napoleonic scenes framed by laurel wreaths were designed by Georges Zippelius and printed from stipple engraved rollers by the firm of Koechlin et Ziegler in Mulhouse, Alsace, France. Both textiles are from the Harry Wearne Collection, gift of Mrs. Harry Wearne.

Copperplate printing on cloth was replaced by copper roller printing in the first years of the 19th century. Thomas Bell, a Scotsman, had his printing machine patented in 1783 but it took some time for the technique to become popular. The printed repeat patterns produced by a roller are the same in every respect as plate prints except that their size is limited by the circumference of the roller; the largest being 57 cm. Like plate prints, the roller prints were monochromatic. By varying the proximity of the engraved lines to each other and the depth to which they were cut, as well as through the use of stippling, light and shade could be suggested. Stipple marks were created for the pattern by hammering the roller with a blunt-point tool, and it was a particularly popular technique for furnishing fabrics from about 1825 to 1840.

Combined Roller and Block Printing

The "pillar print," named for the motif, was one of the most popular English textile patterns. This example, which dates from 1826, was engraved by Joseph Lockett, who ran an independent shop, and printed by Samuel Matley of Hodge, Cheshire. The red parts of the pattern were printed from stipple-engraved rollers, the pale yellow colour was added by block printing. Purchased by Betty Brett from Cora Ginsburg, New York.

Before the technique of polychromatic roller printing was developed around the middle of the 19th century, additional colours had to be added to roller-printed textiles through block printing.

PHOTOGRAPHY DEPT., ROYAL ONTARIO MUSEUM

White on Blue Prints

Festoons of lace, tassels, and floral sprays are the pattern motifs of these two furnishing fabrics. The one on the left is a resist print on linen from the 18th century; the one on the right is a discharge print on cotton from the 19th century. Both textiles are from the Harry Wearne Collection, gift of Mrs. Harry Wearne.

In 17th and 18th century Europe, a resist, a paste of various ingredients, was applied to the textile by means of wood blocks before the textile was dipped into a vat of indigo. This two-step process produced a monochromatic pattern. In the early part of the 19th century, it was discovered that dyes could be removed from as well as applied to cloth. This made it possible to reverse the process of printing and dyeing. First the fabric was dyed in a vat of indigo and then a bleaching agent called a discharge was printed onto the coloured cloth. The drawing of the patterns was much finer in all details because rollers rather than blocks were used for printing.

PHOTOGRAPHY DEPT., ROYAL ONTARIO MUSEUM

Victorian Chintz

This furnishing fabric was a contribution to the Great Exhibition by Japuis & Fils, Paris, and it shows a pattern that was very favoured at the time. The repeat pattern of multi-coloured roses, foliage, daisies, and convolvulus tied together with a blue ribbon and posed on a plum ground measures almost 1.5 metres in height and fills the whole width of the cloth, almost one metre. Such floral design is still popular, however, modern examples are almost exclusively screenprinted adaptations.

Fabrics printed in the middle of the 19th century were particularly rich and a splendid selection was exhibited at the Great Exhibition in the Crystal Palace in 1851.

Block Printing in the 19th Century

In spite of the rapid printing techniques using copper plates or rollers developed in the industrial age, multi-coloured furnishing and clothing fabrics continued to be block printed throughout the 19th century and well into the 20th century. Block printing was the only technique that permitted the use of an unlimited number of colours and could give a depth of tone not attainable with other methods because the dyes were always applied onto dry cloth.

Mezzari or Genoese Veils

Many blocks were needed to print the pattern on this mezzaro, which was woven as a single piece of cotton fabric, 274 cm wide. The stamp at the bottom and centre of the textile indicates that the piece was produced in Sampierdarena. It was there that Michael Speich from Switzerland set up a factory for cotton printing in 1787 that was eventually taken over by his cousin Luigi Testori. Testori's name and the fact that the design won an award in 1840 are also mentioned on the stamp.

A very special kind of printed cotton, the mezzari, were produced in Genoa, in northern Italy. Local peasant women covered their heads with mezzari. The patterns of these textiles were influenced by the Indian chintz, flowering tree patterns that were introduced to Europe one hundred years earlier.

William Morris

William Morris's rose design, registered in 1883 and produced at his Merton Abbey works, was "the most widely popular of all the Morris chintzes," according to a sales catalogue at the turn of the century.

In the late 1860s William Morris, a key figure in the English Arts and Crafts movement, wished to print the fabrics that he had designed, himself. Aniniline dyes had just been discovered but their colours were garish, bled when washed, and faded quickly in light. Consequently Morris decided to use traditional vegetable dyes and traditional methods. Morris strongly believed in the dignity of individual human work and feared that it was being threatened by industrial mass production.


Rub shoulders with Royalty.
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De Luxe
y · Whisky Canadien
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TARIO · CANADA
Crown Royal

Twinkle,
twinkle
little star

REJUVENATING THE STARS

how
they
wonder
what
age
you are

JOHN KENNY

"WE DIDN'T SET OUT TO GO AGAINST POPULAR WISDOM," EXCLAIMS AStronomer Dr. Peter Stetson, "but we were pretty excited about the results." Stetson is referring to the discovery he made with his colleague, Dr. Michael Bolte, that some members of the Milky Way galaxy may be as much as 30 per cent younger than previously thought. That translates into a difference of three or four billion years, and the discovery has some radical implications for theories of how the Milky Way, the galaxy in which we live, was formed.

Stetson and Bolte work at the National Research Council's Dominion Astrophysical Observatory in Victoria, British Columbia. They have been studying groups of stars known as globular clusters, spherical clumps of up to a million stars bound together by gravity. About 160 globular clusters surround the Milky Way. Their orbits are randomly oriented, but together they form a spherical swarm known as the galactic halo. (The halo also contains millions of individual stars in addition to those found in the globular clusters.)

It has been known for some time that the halo contains some of the oldest stars in the Milky Way. The question is just how old. For several decades most astronomers believed that all globular clusters formed simultaneously when the Galaxy was born. Stetson and Bolte's discovery indicates that they formed over a span of several billion years.

Why is there so much fuss over a few billion years, one way or the other, in the dating of globular clusters? According to Professor Ray Carlberg of the University of Toronto, a specialist in theories of galaxy formation, "We've known for several years that there are differences between globular clusters. There are differences in chemical composi-

John Kenny is a freelance writer based in Toronto.

Anatomy of a Galaxy

ILLUSTRATION BY BILL IRELAND

THE MILKY WAY GALAXY CONSISTS OF three major components: the core, the disc, and the halo. Like the yolk of a fried egg, the core bulges out from the surrounding disc. And surrounding the disc and core is the spherical swarm of halo stars and star clusters.

The core is a mass of densely packed older stars measuring some 10,000 light years across. (A light year is equal to the distance that a ray of light travelling 300,000 kilometres per second would cover in one year or 10,000,000,000,000 kilometres.) Stars in the core are hundreds of times closer together than in the region of the Sun. With so many stars in its sky, a planet situated in the core would never know true darkness. Indirect evidence suggests that an enormous black hole, several million times more massive than the Sun, may lurk at the very heart of the Milky Way.

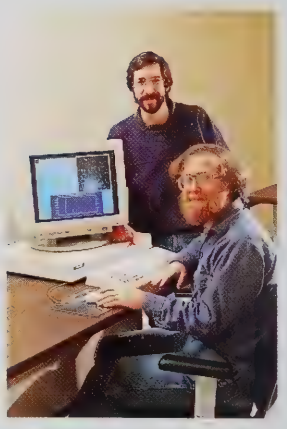
The Sun is situated in the disc of stars that surrounds the core. Earth is about 30,000 light years from the centre of the Galaxy. Overall the disc is about 100,000 light years in diameter and about 1000 light years thick in the outer regions.

The disc contains not only stars but also vast clouds of interstellar gas and dust. These nebulae, as they are called, are regions of continuing star formation. For reasons not completely understood, the hottest and brightest stars form along twisted arms that give spiral galaxies such as ours their name.

Surrounding the disc is the galactic halo. Individual stars and globular clusters orbit the Galaxy like insects swarming around a light bulb. Their paths are seemingly chaotic, but they form a spherical cocoon extending just beyond the edge of the disc. Star formation stopped here long ago, and halo stars are among the oldest in the Galaxy.

In total the Milky Way contains some 400 billion stars. In photographs, galaxies like ours give the appearance of solidity, with their tightly wound spiral arms and bright cores, but this is merely illusion. The spaces between the stars are millions of times larger than the stars themselves. Most of the Galaxy is just empty space.

Dr. Peter Stetson, seated at the computer, and Dr. Michael Bolte, standing behind him, are astronomers with the National Research Council Dominion Astrophysical Observatory in Victoria, British Columbia. Through their research on the ages of star groups called globular clusters, they are making astonishing discoveries that may disprove accepted theories on the formation of the Milky Way galaxy.



COURTESY DOMINION ASTROPHYSICAL OBSERVATORY VICTORIA, B.C.

tion, differences in orbital velocities, but until recently there hasn't been any really good data on ages. We need that information to test our theories."

Measuring the ages of stars several times older than Earth by analyzing their faint, shimmering light is not as easy as it might seem. "It's exacting work, demanding extreme precision. That's what I like about it," says Stetson with a chuckle. "If I wasn't an astronomer, I'd probably be a watch maker." While in practice the process is laborious and exacting, the basic principles are both ingenious and fairly straightforward.

Stetson and Bolte are performing the difficult task of measuring the ages of stars by analyzing their light to prove that globular clusters formed at different times, not simultaneously

The key is contained in a deceptively simple-looking chart that compares the colour and brightness of stars. It is called a colour-magnitude, or Hertzsprung-Russell, diagram. The latter name refers to Ejinar Hertzsprung and Henry Norris Russell, who first discovered the relationship of colour and brightness at the turn of the century. In Stetson's words, "The colour-magnitude diagram is kind of like the Rosetta stone of astronomy."

Of course, the apparent brightness of a star in the sky is affected by its distance from Earth. A faint, nearby star can outshine an intrinsically brighter one by virtue of its proximity. By compensating for the effects of distance, a star's true brightness, or absolute magnitude as it is called by astronomers, can be determined. Knowing the absolute magnitude permits the comparison of stars on an equal basis.

The brightness, colour, and life span of a star are determined almost exclusively by its mass. The heaviest, most massive stars produce energy in such prodigious quantities that they are both the brightest and the hottest stars. They burn with a fierce blue-white light, thousands of times brighter than the Sun. However, they are also the shortest-lived of stars. Despite their huge mass, they consume their supply of hydrogen fuel in a few tens of millions of years.

Cooler, less massive stars like the Sun shine with a more sedate yellowish light. The Sun is only half way through its estimated ten-billion-year life span. Stars less massive than the Sun are cooler still, emitting an orange light. The least massive and coolest of all shine with a feeble red glow. Yet these so-called red dwarfs may still be shining a hundred billion years after the Sun is a cold, long-forgotten cinder.

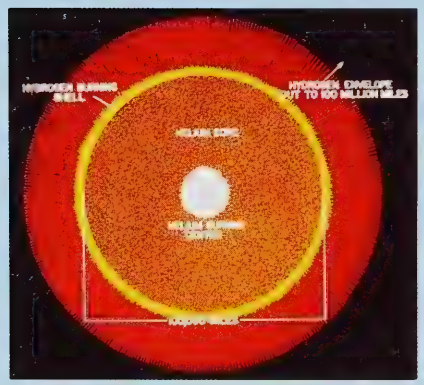
In the colour-magnitude diagram, stars are plotted with brightness increasing towards the top and temperature decreasing towards the right. The result is a neat grouping of stars ranged in a curved, sweeping line with the hot, blue, brightest stars at the upper left and the cool, red, dim stars at the bottom right.

This range of stars is known as the "main sequence." These are normal stars like the Sun, which produce nuclear energy in their cores by converting hydrogen into helium. As long as a star has a supply of hydrogen in its core, it remains relatively fixed on the main sequence; its brightness and temperature change only slightly.

Once a star exhausts its supply of hydrogen fuel, it cools and reddens, but maintains roughly the same overall brightness by swelling in size. On the colour-magnitude diagram, the star moves off the main sequence horizontally to the right. This is known as the main sequence turn off. From there the star moves to the regions of the colour-magnitude diagram populated by red giants and later, white dwarfs.

In a cluster of stars that form at the same time, the first ones to move off the main sequence will be those at the upper left of the colour-magnitude diagram—the hottest, brightest, and shortest-lived stars. As the cluster ages, the main sequence turn off will gradually move down to the right. The age of the cluster can then be determined from the life expectancy of the brightest stars still on the main sequence.

The Life of a Star



The internal structure of a star is shown in the first red giant stage just after the helium flash. There is a helium burning core, a hydrogen burning shell, and an extensive hydrogen envelope.

ALL STARS FORM FROM INTERSTELLAR clouds of gas and dust. If a cloud's density reaches a critical limit, then it will start to collapse under its own weight. As gravity compresses the cloud, heat and pressure begin to rise in its core.

When the central temperature reaches about two million degrees Celsius, hydrogen fusion begins. In this nuclear reaction nuclei of hydrogen combine to form helium. This is the same process that powers a hydrogen bomb.

The heat released by hydrogen fusion creates pressure that pushes out against the compression of gravity. Eventually a balance is reached between these two forces. The collapse stops and the star joins the main sequence.

That balance between the inward squeeze of gravity and the outward push of heat energy lasts as long as there is hydrogen in the core to fuel the fusion reaction. When the central supply of hydrogen is exhausted, the core begins to collapse under its own weight again. The collapse heats the core even more. Hydrogen begins to fuse in a shell outside the core. If the star is massive enough, helium becomes the fuel for a new set of nuclear reactions within the core.

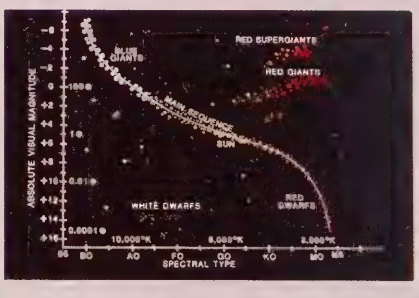
The new outpouring of energy pushes the star's surface layers outwards. They expand and cool, but because of the increased surface area, the star is actually brighter overall. The star has moved off the main sequence upwards and to the right, to become a relatively cool but bright star, a red giant.

Massive stars may experience other fusion reactions once their core supply of helium is consumed. Eventually though, when all sources of energy are exhausted, the core begins to collapse once again. For a star like the Sun, the collapse stops when the electrons in the core resist any closer packing. At that point the mass of the Sun is packed into an object the size of the Earth. A teaspoonful of this incredibly dense material would weigh more than 40 tonnes.

Instabilities meanwhile drive the surface layers off into space, leaving the intensely hot, compressed core exposed. The star has become a white dwarf. Though the white dwarf is very hot, its smaller surface area does not give off much total light. The star has moved from the cool but bright red giants to join the white dwarfs at the lower left side of the colour-magnitude diagram.

For a few very massive stars a more dramatic fate awaits in the form of neutron stars, black holes, and supernova explosions. For most, however, becoming a white dwarf is the end of the line. The white dwarf cools and eventually fades. It finally disappears as a black dwarf, the burnt-out cinder of a star.

Invented by Ejinar Hertzsprung and Henry Norris Russell, the colour-magnitude diagram compares the colour and brightness of stars, which makes it possible to determine their ages. According to Peter Stetson, the colour-magnitude diagram is like the Rosetta stone of astronomy. The age of a globular cluster can be determined from the life expectancy of the brightest stars plotted on the main sequence of the diagram, the range of stars in a cluster that are still burning hydrogen.



SCIENCE GRAPHICS

In principle, nothing could be easier. Reality is another matter. Peter Stetson explains: "The stars we studied were up to 100 million times fainter than you can see with your eyes. This kind of work requires access to large telescopes and enough time to make lots of measurements. And again accuracy and consistency are critical. An uncertainty of even one per cent could mean a difference in age of a couple of billion years."

"Before 1983 that sort of accuracy was impossible," says Michael Bolte. "Even in the best photographic studies it was impossible to distinguish age differences as large as four billion years. Now with sensitive new electronic light detectors called CCDs and the sophisticated computer software to go with them we have the accuracy we need."

CCDs or Charge-Coupled Devices are light-sensitive electronic chips. They can detect up to 80 per cent of the light that falls upon them. Photographic film, by comparison, registers at best only a fraction of one per cent of the incident light. Charge-Coupled Devices have revolutionized the imaging industry from spy satellites to home video cameras.

In astronomy CCDs mean that images that used to take all night to capture with conventional cameras can now be captured in a few minutes. Observational errors are also reduced because the brightness signals from the CCD can be fed directly into a computer for analysis instead of going through intermediate measurement. Peter Stetson wrote the computer program for analyzing the results. This program is now the most widely used software in the world for the analysis of CCD brightness measurements.

Stetson and Bolte were also aided by the work of another British Columbia astronomer, Dr. Don VandenBerg of the University of Victoria. VandenBerg specializes in modelling the internal structure of stars. "Not all stars are the same," explains VandenBerg. "They differ not only in size and age, but also in composition, rotation, and other things. It's important to know how these differences affect stars so that we can calibrate our observations." For example, a star's colour and brightness can be subtly affected by its "metalicity," the presence of trace amounts of oxygen, iron, and other heavy elements in its composition. These subtle differences are enough to affect age measurements by billions of years.

Stetson and Bolte believe that one globular cluster, Pal 12, could be as much as 30 per cent or 3 to 4 billion years younger than the oldest globular clusters

By knowing the metalicity of the stars they studied, Stetson and Bolte could calibrate their colour-magnitude diagrams and refine their age estimates. Their results indicate that not all globular clusters have the same age. One in particular, known as Pal 12, could be as much as 30 per cent or 3 to 4 billion years younger than the oldest globular clusters.

In 1962 the American astronomer Allan Sandage and his co-workers proposed a theory which stated that the Galaxy formed more or less at once. An enormous, primordial cloud of hydrogen and helium gas collapsed under its own weight. The first stars formed while the cloud was still roughly spherical in shape. These were the globular cluster and other halo stars.

As it collapsed further, centrifugal force from the cloud's slow rotation caused it to spread out and to flatten to a disc shape. The gas was concentrated in the disc, leaving the globular clusters and other halo stars as remainders of the Galaxy's earliest days. This theory has been widely accepted.

"In the old fast-collapse model," Bolte says, "all the gas is concentrated in the galactic disc fairly quickly. That means that the globular clusters have to form simultaneously. Our results for Pal 12 indicate that objects in the halo formed over several billion years."

Charge-Coupled Devices

CANADA-FRANCE-HAWAII TELESCOPE

The tiny charge-coupled device (top) contains 163,840 light-sensitive electric circuits that create and store images. At the end of each exposure, additional circuits in the chip control the transfer and readout of the data to a waiting computer, such as the one at the Canada-France-Hawaii Telescope (bottom).

CHARGE-COUPLED DEVICES OR CCDs have revolutionized optical astronomy. A CCD is a type of silicon chip, specially treated with gallium, arsenic, and other substances to make it sensitive to light. It's really a light-meter counting the photons that fall upon it. In fact, a CCD is like many light-meters packed together.

Each CCD is split up into hundreds of thousands of pixels. (Pixel stands for picture element.) Each pixel measures the brightness of a very small portion of the image that falls on the CCD. CCDs have several advantages over conventional photography. First of all they are hundreds of times more sensitive than film. Some experiments with supercooled CCDs are reaching detection efficiencies of almost 99 per cent. This means that exposures which used to require all night or even several nights can now be accomplished in under an hour.

CCD data are essentially numbers, a count of the number of photons detected by each pixel. This makes the information extremely amenable to computer enhancement. Subtle differences in contrast, for example, which might escape the eye in a photograph, can be enhanced by computer processing.

Turbulence in the atmosphere has always been a problem for astronomers. It tends to blur photographic images. CCDs are so sensitive and so quick that it's possible to measure the amount of turbulence and compensate for the blurring as the exposure is made. The resulting images rival those taken in the pristine clarity of space. CCDs are allowing astronomers to see fainter objects in less time and greater detail than ever before.

Globular clusters, such as the one pictured here, are spherical clumps of up to a million stars bound together by gravity. Their orbits are randomly oriented, but together they form a spherical swarm in the Milky Way galaxy known as the galactic halo. About 160 globular clusters surround the Galaxy and they date back to its earliest days. Instead of coming about because of the collapse of one enormous primordial cloud of hydrogen and helium, the halo may have formed through the merger of 50 to 200 cloudlets.

CANADIAN-FRANCE-HAWAII TELESCOPE

Bolte believes that two other globular clusters, NGC 1261 and NGC 362, are between 1 and 2 billion years younger than other clusters. He still believes that globular clusters are remainders from the early history of the Galaxy, but he proposes modifying that history somewhat. Instead of the collapse of one huge cloud, Bolte suggests that the halo and perhaps a significant portion of the Galaxy itself may have been formed by the merger of 50 to 200 cloudlets.

As the young Milky Way grew, it would have gradually absorbed the surrounding cloudlets. The remaining gas would have been absorbed into the galactic disc while any stars in the cloudlets would have remained in the halo. Their irregular orbits, Bolte suggests, are a legacy of their having "fallen into" the Milky Way.

As further proof Bolte looks at the differences in metalicity among globular clusters. These, he claims, are much easier to explain if the clusters had formed independently rather than simultaneously from one homogeneous gas cloud. Finally, Bolte refers to observations of other galaxies. Astronomers have found that several of the larger galaxies in the universe practise cannibalism, increasing their size by devouring their smaller neighbours. "The idea of gradual formation has been around since 1977," Peter Stetson is quick to point out. "There was just never any proof. We've provided the proof."

Ray Carlberg concurs. "Current theories of the early universe predict that there would have been a lot of little lumps of gas as well as big ones. Those little lumps would have been like a bunch of ping-pong balls covered in velcro; when they met they would have stuck together, but it wouldn't have happened all at once. It's inconceivable for there to have been no star formation in those little lumps before they joined. The star formation would have been leisurely giving rise to a range of ages."

Not everyone agrees with Bolte and Stetson. Even Don VandenBerg has reservations. "Pal 12 definitely appears to be significantly younger, but I don't necessarily agree with their conclusions on the other clusters. Pal 12 is a very sparse cluster, and it's extremely far away. This may be just one more unusual feature about an unusual cluster."

The calculation of the ages of globular clusters is hampered by two factors. Space is filled with dust, which tends to redden the light of distant objects. Astronomers compensate for this by assuming a certain "reddening value." While these estimates are reasonably accurate, even small errors can have dramatic results. The second factor is distance. The distance of a globular cluster from Earth must be calculated in order to construct an accurate colour-magnitude diagram.

In the world of science each new piece of information is tested and evaluated before being accepted. If the information is found to be inaccurate, then it blocks off one more blind alley in the elusive search for the truth. "By and large, reaction has been pretty good," Bolte claims. "Someone may come up with a better explanation for our findings, but I'm confident that our data will hold up in the long run." Ray Carlberg agrees. "In retrospect, there were always problems with the old theory. There are problems with any theory, even this one, but our findings fit very well with current models."

Indeed, confirmation for differences in age of globular clusters is being found by researchers around the world. Even conservatives, like Allan Sandage, are beginning to admit that there are a couple of globular clusters with unusual ages. The question is, are they exceptions or are they examples of a broad range of ages? Further observations should settle the issue within the next couple of years. But as with all scientific theories, the future will bring some young researcher with an enquiring mind and a better means of observing and recording the universe to challenge the conventional wisdom once again.

There are problems with any theory but the findings of Stetson and Bolte fit very well with current models of the compositions of the Milky Way and other galaxies

Science and Athena's Shield

At last Perseus found the Gorgons. They were asleep among the rocks, and Perseus was able to look at them safely.

Although they were asleep, the live serpents which formed their hair were writhing venomously. The sight filled Perseus with horror. How could he get near enough without being turned to stone?

Suddenly Perseus knew what to do. He now understood why Athena had given him the shining bronze shield. Looking into it he saw clearly the reflection of the Gorgons. Using the shield as a mirror, he crept forward. Then with a single swift blow he cut off the head of the nearest Gorgon. Her name was Medusa.

In one mighty swoop, Perseus grabbed the head of Medusa. He placed it safely in his bag and sprang into the air on his winged sandals.

From **Famous Legends**, Book 1, by J. D. M. Preshous. Ladybird Books, Series 740, Loughborough, 1975. Illustrated by Robert Ayton.

WHEN I FIRST BEGAN TO PLAN A university course on human evolution, I was faced with several problems. Not the least of these was how to present the kind of factual information necessary to an understanding of the mechanisms of human evolution as it is now interpreted, yet construct the learning framework in such a way that the students could, at any given point, step outside it. Stepping outside the framework would allow them to get a perspective on evolution as theory—a way of posing questions about nature and the physical world that has alternately been extolled, ignored, revamped, evangelized, vilified, and even declared obsolete. It did not take long before it became clear that the concept of evolution was intimately bound to the concept of science. One could not begin to discuss evolution as a working hypothesis unless one accepted science and the scientific method as the framework.

This seems self-evident at first, and not open to debate, especially when the topic is something as specific as comparative locomotory characteristics among *Hominidae* (apes and humans). But when we look at theories of the origin of life and the universe, science appears as much myth as reality. After all, images of chaos—the disorder of formless matter and infinite space—appear in all creation scenarios, including that of science, and the progression from chaos to

inorganic matter to life, usually with water providing the conditions of change, is a common theme. Furthermore, none of the creation stories, including that provided by science, explains exactly how life arose from non-life. It can almost be described as an article of faith on our part that the range of explanations put forward under the rubric of science brings us closer to the truth about the origins of our world than do the origin myths of the Babylonians or the Aztecs.

Why, then, are we biased in favour of the scientific explanation? Are other explanations, such as those in the realm of myth or religion, thereby condemned as false, or merely harder to prove true? Most people would say that non-scientific explanations require faith, not proof. But science, too, requires faith. What, if anything, makes faith in science different from faith in myth or religion?

In attempting to emphasize the role that faith has in science, I searched for a way to get students to question assumptions that they had come to think of as unassailable. It had to be clear to them that in "doing" science both objectivity and subjectivity play a part. But how was I to demonstrate this in a way that could be envisaged for all situations? One evening, after reading a bedtime story to my older son, I had an idea. I had been reading to him from a young people's version of the *Iliad* and the *Odyssey,* and it reminded me of a version of the most popular Greek myths and legends that we had read the summer before. The story he especially liked was "Perseus and the Gorgon's Head."

Perseus sets out and is aided, to his surprise, by the goddess Athena and the god Hermes in his unenviable task of bringing back the head of a Gorgon. Hermes gives Perseus winged sandals and a helmet of invisibility, but Athena gives him more—a magic sword and a splendid bronze shield, polished to perfection. Perseus is not sure at first what use the shield will be against the Gorgons, who wield no weapons. After a series of adventures he comes to the Gorgons' lair. Asleep among the rocks are the three female monsters with snakes for hair, whose mere glance turns men to stone. As he considers an effective strategy, Perseus suddenly realizes why Athena gave him the shield. Its mirror-like quality enables him to view the Gorgons without turning around, and to gauge his distance from them as if he were seeing them with his own eyes. Quickly he brings Medusa, the nearest Gorgon, into view, and with a single powerful blow cuts off her head. This was the powerful image of science that I had been seeking. What a wonderful metaphor: science as Athena's shield—a reflection of reality, but one with practical applications.

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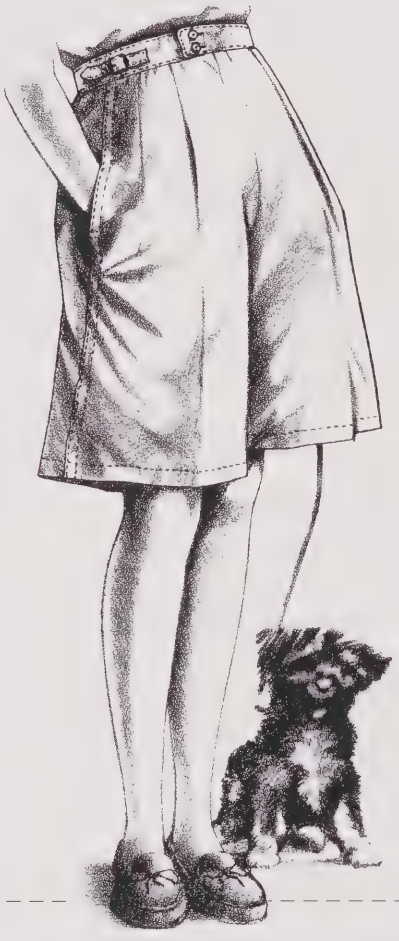
Science and the natural world have, of course, been viewed by many as less real, or perhaps less certain, than the discoveries and discoverers imply. What first comes to mind is Plato's view, expressed in *The Republic*, that reality exists only as eternal ideas. These ideas cast images which are the visible, material world that we attempt to describe. But this world is no more than a dance of shadows—images of an eternal realm of ideas, but not reality. Hence, according to Plato, measuring the material/natural world, or attempting to understand it, is not something to lose much sleep over.

The emphasis on the observer over the observed is the anchor for other distant but related criticisms, in which science is characterized as an extension of the observer. We can understand these sorts of criticisms, and see validity in the argument that it is only possible to define the world in terms of one's perception of it. But if we try to fit science into this self-contained view, it doesn't work.

Science has enabled us to change and manipulate the world around us in a way that Plato's imagery cannot account for. Philosophers of repute have agonized over the nature of science with great relish through the ages. It is the stuff of which great theories are made. Many philosophers seem obsessed with what they call the logic of proof. Perhaps the greatest impact in this vein has been made by Karl Popper in his *Logic of Scientific Discovery*. A smaller number are fascinated by the logical, or in many cases the seemingly illogical, steps that lead to the birth of an original idea. Fascinating and meticulously researched accounts of pathways to discovery, and controversy, can be found in Arthur Koestler's books. *The Sleepwalkers*, for example, is an extraordinary revelation of the drastically different courses followed by Copernicus, Kepler, and Galileo.

In a recent publication, *The Scientific Image* by Bas Van Fraassen, the emphasis is the same as mine, though elegantly expressed by someone a colleague of mine has called "a philosopher's philosopher." Van Fraassen ties our faith in science to its success in manipulating observable phenomena. The insight gained by the scientific approach permits people to alter to varying degrees the physical nature of the world. This sort of manipulation is exemplified by the metaphor of Perseus' predicament. How better could Perseus slay one of the Gorgons than by means of the mirror-like shield? With one calculated blow he made off with the coveted Gorgon's head. The shield, like science, is used to manipulate the world to man's ends. Yet it is not reality, but only the way reality appears.

This metaphor can be carried



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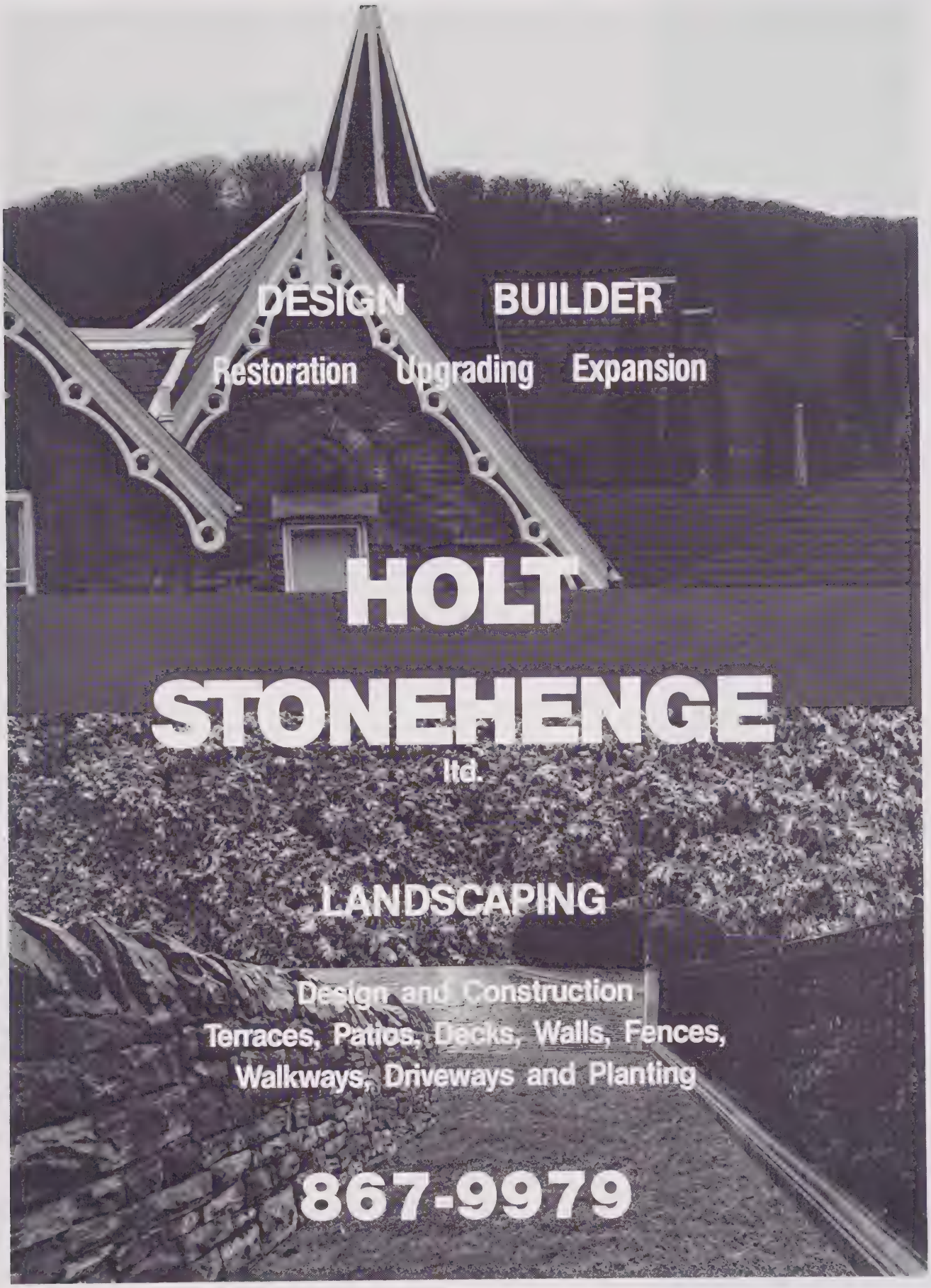
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further, and with this in mind, the first assignment I gave the students was to consider the implications of this metaphor. Did it matter who held the shield, or how it was used? What if it was held by a woman—would science be different for that? If so, in what way? If the mirror-like shield were held very close to something, the details would be clear but the observer would be unable to take in the larger context. If the shield were held farther away, it would reflect a panoramic view but detail—the mechanisms of change—would be blurred. Can both images be considered science?

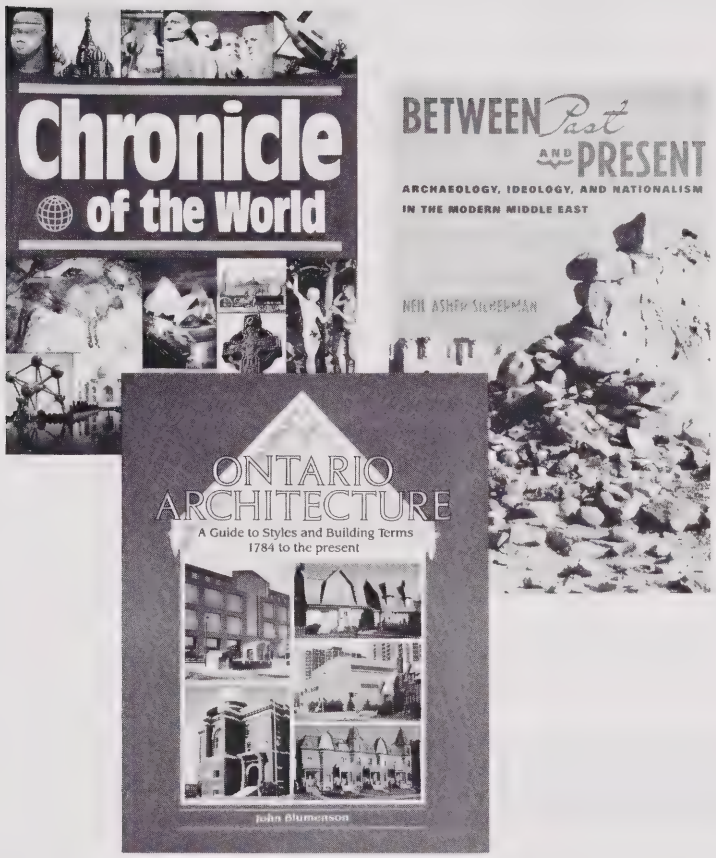
To return to our hero, proximity increased his accuracy, but Perseus also needed some arm-swinging room. In a metaphor like this, the middle ground—the world within reach—is where action is possible. But in terms of gathering information, there is no way to reconcile the extreme views except, perhaps, to use more than one mirror. Inevitably, the clarity of one image is lost as the viewer moves in one direction or the other. Perhaps this, too, is science, and would help to explain the seeming inevitability of unresolved conflicts among its practitioners.

Stephen Jay Gould's emphasis on contingency (fortuitous change) in evolution is Perseus with his shield at a short distance from the natural world. In citing contingency, the focus is on detail or mechanisms of change and on the specific conditions surrounding the course of events leading to change. Gould has cited the example of *Pikaia*, the only chordate of the Burgess Shale formation in the Rockies. As a chordate, *Pikaia* is our ancestor in body plan, but not explicably or predictably better adapted to Cambrian conditions than any of the other wondrous creatures of the Burgess. Yet a certain string of circumstances led to the triumph of its phylum.

There are scientists who disagree with the importance of such an emphasis on contingency. Perseus would say it is a matter of perspective. In *Wonderful Life*, Gould's recent book about scientific process and the Burgess Shale, he turns Athena's shield towards the intricacies of change, and contingency looms large on the horizon. Other scientists, including Gould in other circumstances (his and Niles Eldredge's punctuated equilibrium) are interested in the pattern of the results of change over time. Here, the shield must be held at a greater distance from the data. The advantage is that from this perspective, repeatable patterns emerge from what may well, on closer inspection, be contingent and unpredictable events. Detecting patterns in physics, biology, or human behaviour can help in predicting the way the world is headed. Unfortunately, the sticky part is doing something about it when life doesn't look all that wonderful. The eternal problem (Plato would say, "told you so") is that patterns are detected at one level, and change effected on another. After all, Perseus sought Medusa armed not only with Athena's shield but with information that had accumulated diachronically on the habitat and behaviour patterns of Gorgons.

We discussed some, but not all, of the implications of the Perseus metaphor in class. Other aspects come to mind as I write. That the shield is the property of a female, and only borrowed by a male, is not uninteresting. There is also the matter of turning to look at the Gorgons directly. Perhaps the myth is, in the end, about the quest for knowledge. If so, a clear warning lies therein. Using the mirror of science may bring us as close as we can get to reality, at least safely. Anything further, as Perseus' petrified predecessors learned, carries the risk of dire consequences.

ELIZABETH GRAHAM *is an associate professor of anthropology (Canada Research Fellow) at York University and a research associate of the Royal Ontario Museum.*



Ontario Architecture: A Guide to Styles and Building Terms 1784 to the Present
John Blumenson
Fitzhenry and Whiteside
255 pp. $40.00 (cloth)

Lovers of Ontario architecture have never had it exactly easy, but many of us have enjoyed the difficulties of our odd, rather lonely passion. Clutching inadequate, enthusiastic leaflets that we tracked down in the local chamber of commerce or the town hall or the constituency office, we pored over towns like Perth, Cobourg, and Paris. Back home, we pondered the sometimes labyrinthine prose of Marion MacRae and Anthony Adamson's books on Ontario houses, churches, and civic buildings. We gave thanks for the readable scholarship of Parks Canada's series on individual architectural styles, for the local history in Mary Byers and Margaret McBurney's books, for the brio of Patricia McHugh's *Toronto Architecture.* And when scoffers expressed astonishment at the idea of a day spent in Woodstock looking for Regency cottages, we learned to smile vaguely.

One thing we lacked was a compendious guide to Ontario architectural styles. We made do with American books, mentally adjusting a cornice here, a pediment there, trying to decide if the Italianate fashion or the bungalow changed when they crossed the border. John Blumenson's *Ontario Architecture: A Guide to Styles and Building Terms 1784 to the Present* should have been the answer to our prayers. Sadly, although it has many merits, it is not the style guide we need.

The signs that Blumenson, the author of *Identifying American Architecture* (1977) and a Preservation Officer with the Toronto Historical Board, never worked out the nature of his intended audience are clear from the beginning of the book. Although he hopes that readers, having "sampled the grammar and vocabulary" of Ontario architecture, will go on to investigate their own surroundings, he frustrates them at several important turns.

Blumenson's most baffling omission is his failure to provide a glossary. Sometimes the unexplained technical terms can be understood from the photographs; often they cannot. Readers familiar with

metopes, triglyphs, tympanums, lunettes, stylobates, raked cornices, battered window jambs, anthemions, fret mouldings, and paterae probably don't have much need for most of this book anyway. Even those of us who have a nodding acquaintance with the terminology like to have a glossary close by, and newcomers will be simply bewildered.

While Blumenson's hundreds of fine photographs will whet the reader's appetite, they appear without addresses except for their town or county so as to protect their owners' privacy—surely a needless, self-defeating piece of conscientiousness. Not only is it hard to imagine hordes of architecture-mad tourists swarming a Colonial Revival house in Kirkland Lake, but many of the buildings pictured are public ones. Almost none of the buildings are dated, although many dates are readily available and some of the styles span more than sixty years.

Nor is Blumenson's prose likely to captivate the reader. This sentence is typical: "*The Italianate stretches the confines of academic eclecticism by distorting the individual historical elements, then synthesizes them into a 'new' arrangement devoid of that historicism normally associated with academic or analytical eclecticism.*" Aside from his dry-as-dust style, Blumenson needs to be reminded that architecture is more than a collection of motifs. Buildings speak of history, patterns of immigration, raw materials, about ideals (as in the Gothic Revival) as well as strategies of social climbing (as in the conspicuous consumption of Second Empire)—but you wouldn't know that from reading *Ontario Architecture.*

And yet there are admirable aspects to Blumenson's book, particularly in the second, more modern half of the book where the territory is fresher. The author has a meticulous, reliable eye for the subtle gradations between differing styles, and he makes imaginative choices when it comes to illustrations. It's fine to have the Georgian bones underneath 19th-century excrescences pointed out, and to have an illustration from a Victorian pattern book and a photograph from a similar Toronto Italian villa on the same page. The frequent inclusion of little-seen houses from Northern Ontario—from Sudbury, Sault Ste. Marie, Thunder Bay, Kirkland Lake—is a particular delight. Now that he has assembled such a lot of knowledge and scholarly exactitude between two covers, Blumenson's next project might well be a smaller, more thoughtful, more user-friendly version of the same style guide. We who love Ontario architecture are used to waiting.

Reviewed by KATHERINE ASHENBURG, *Arts and Book editor of* The Globe and Mail

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Between Past and Present
Archaeology, Ideology, and Nationalism in the Modern Middle East
Neil Asher Silberman
Henry Holt and Company
285 pp. $34.50 (cloth)

THE REVERENCE WITH WHICH Canadians and Americans regard their nations' pasts is profound, but changeable. The once-glorious accounts of the conquest of the west, for example, are now tempered by an awareness of the culturally and environmentally destructive nature of that expansion. It comes as no surprise, then, to see that carefully drawn views of the past assume ideological, social, and political functions in today's Middle East. *Between Past and Present* examines a series of archaeological projects in Yugoslavia, Greece, Cyprus, Turkey, Israel, Egypt, and North Yemen and tries to uncover the politics behind the archaeology.

The nationalist politics that

Silberman reveals as driving forces of archaeological exploration and development are often unambiguous. Israeli government support for the excavation of Masada, site of the mass suicide of the beleaguered Jewish revolutionaries in the face of conquest by the Roman legions, neatly illustrates this. The story of Masada has become a parable for the modern state of Israel largely as a result of official promotion. But while nations celebrate some aspects of their past, *Between Past and Present* makes it clear that there are skeletons that some governments prefer to leave buried.

Turkey, contrary to expectation, does not glorify the ruins of Troy. The ancient story of empire and heroism is not attractive as a national epic because it is more Greek than Turkish, and the archaeological memories of its excavation are unsavoury. Troy was excavated by Heinrich Schliemann in an era of archaeological colonialism, and Schliemann's integrity has been called into question.

Silberman is a trained archaeologist with long experience in Israel, and his most vivid and compelling writing concerns Israeli archaeology. Not all the vignettes of Israeli excavation relate to national aspirations. The account of the prehistoric appearance of modern humans side by side with Neanderthals is a sound, concise, and current rendering of the evidence, and a good illustration of changing paradigms in archaeological theory. *Between Past and Present* also describes the problems of clandestine excavations and the illegal trade in antiquities by organized groups, by innocent tourists, and by opportunistic dignitaries such as Moshe Dayan.

The mixed messages of the past find voice in Silberman's three chapters on Egypt. The nation's ambivalence to its Pharaonic history is a clear marker of political issues of the present, from a colonially engendered xenophobia to the growth of Muslim fundamentalism. Local politics never disappear from

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sight: the reader is not surprised by the lack of official enthusiasm to excavate a major temple built by 5th century B.C. Jewish colonists on the island of Elephantine.

Between Past and Present succeeds in engaging the reader in episodes of archaeology, and the messages that derive from the examples are varied. Some of the excavations reveal as much about the modern state as about the past. Others address questions of ethnicity, continuity, and change. Throughout, Silberman personalizes the archaeological experience by examining the motives and emotions of the excavator. But the political impact of some of the projects he visits remains obscure; while personal motivations are made apparent, Silberman fails to map out the multi-level political structures that are part of the archaeological context. Another writer might have looked at other sites (Ebla and Jerusalem spring to mind), and perhaps Silberman would have done better to narrow his focus to a thematically and geographically more cohesive sample. *Between Past and Present* features a single map of selected archaeological sites, but no other illustrations. A good annotated bibliography aids the reader in further research.

Reviewed by DAN RAHIMI, *an archaeologist specializing in Middle Eastern cultures, and a gallery project coordinator at the Royal Ontario Museum*

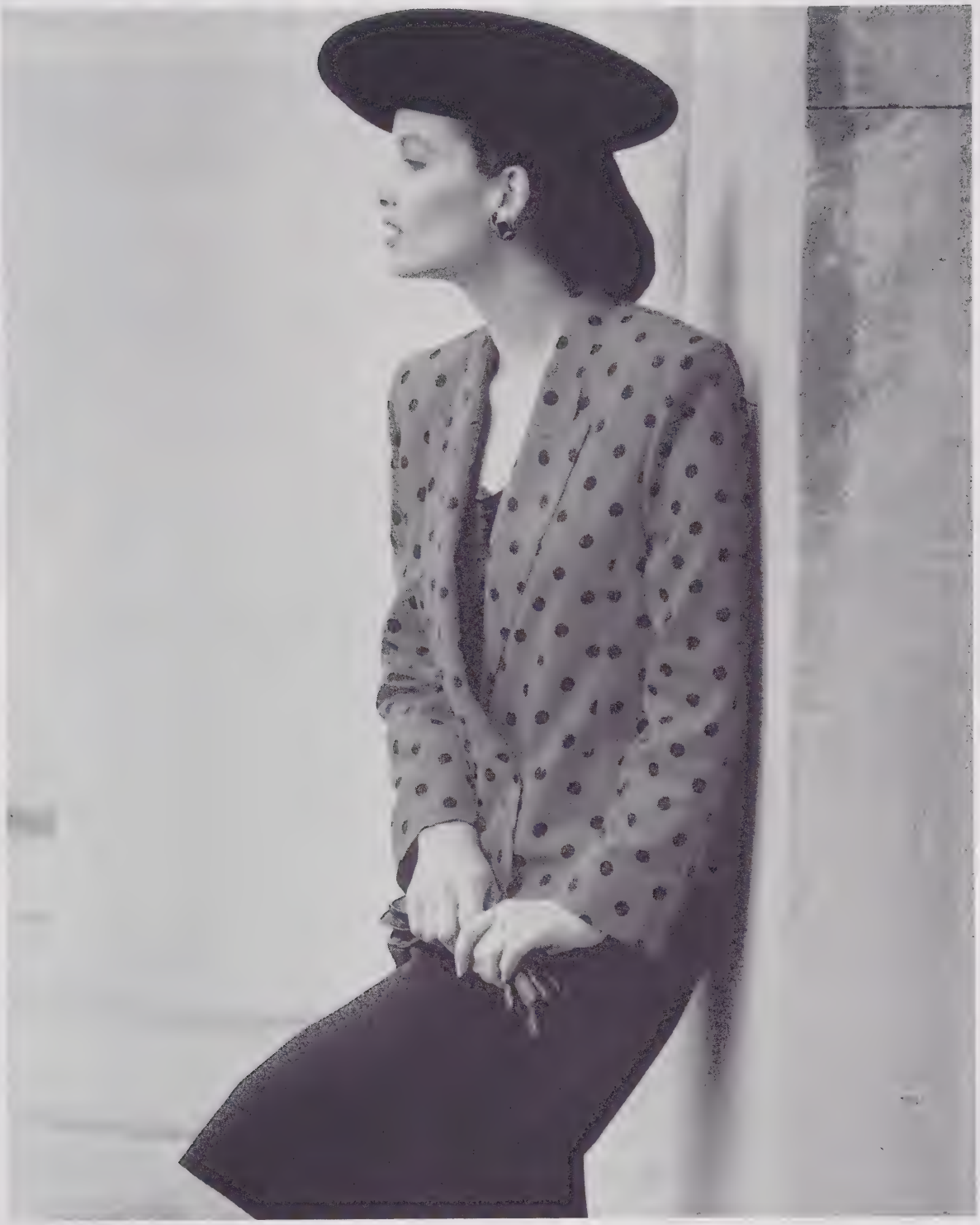
Chronicle of the World
Jerome Burne, ed.,
Jacques Legrand S.A. International Publishing
1296 pp. $59.95 (cloth)

WHEN I WAS ASKED TO REVIEW *Chronicle of the World*, my first thought was that I might eventually see companion volumes such as The Meaning of Life and The Essence of Truth. My cynicism regarding the book's title was erased by my first glance at the massive, 7-cm-thick tome. Here, it seemed, was a volume very likely to fascinate many readers, including my nine-year-old son Conall. The title is entirely apposite; within the 1296 pages of text and index lies enough of the world's history and prehistory to enchant anyone.

Presented in newspaper style are the signal, and sometimes less than signal, events of our planet's past, from a time before life to the end of World War II. The slices of time, thick at the beginning and thinning progressively as the centuries roll by, form chapters headed by one-page essays accompanied by world maps. The "newspaper" items, with catchy titles such as "New Aztec capital fulfills old prophecy" (c. 1345) and "Sultan dies after fall in Turkish bath" (1574) are endlessly fascinating. For my research area, Mesoamerica, the stories have flaws, mostly minor, of sorts that diminish as one moves into places and times that are better known archaeologically or are represented by the written word. One can never say of a 4-kilogram-plus volume, "I couldn't put it down," but it is indeed a goldmine of information and photographs to which any reader will want to return again and again.

I took the book home—no mean feat in itself—and, as I expected, Conall thought it was great. His only complaints were that he couldn't lift the thing, and that it had no thumb-index. For children of his and greater years, the *Chronicle* will provide endless food for thought and fodder for class assignments. For their parents (if they have good memories), the volume will prove an inexhaustible resource for cocktail-party one-upmanship. For everyone interested in the myriad pathways our species has followed down the years, the *Chronicle* exemplifies the best principle of education: learning by wading through its pages is fun.

Reviewed by DAVID PENDERGAST, *curator in the Department of New World Archaeology, Royal Ontario Museum*



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JAY INGRAM

Memories are Made of This

1. Planaria, centimetre-long flatworms that live in freshwater streams and lakes, were the centrepiece of a scientific controversy in the 1960s. It was claimed that they could transfer memories from one to the other by a most unusual mechanism. How were they supposed to do it?

2. In his book *The Man Who Mistook His Wife for a Hat*, neurologist Oliver Sacks describes a man named Jimmie, a victim of Korsakov's syndrome, a profound amnesia caused by heavy drinking. In the 1970s, Jimmie's memory was suddenly erased back to 1945. Sacks describes how one day he suddenly thrust a mirror in front of the 49-year-old Jimmie and asked, "Is that a 19-year-old looking out from the mirror?" Jimmie was suddenly confused and devastated, and Sacks never forgave himself for his impulse. But of course there was really no risk that Jimmie would be traumatized by Sacks' action. Why not?

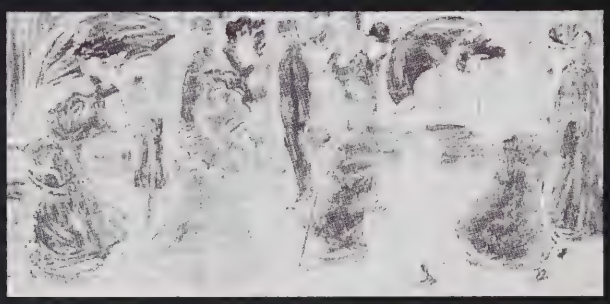
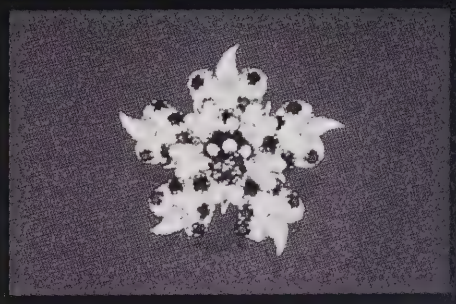
3. A Russian named Shereshevsky made a living from public demonstrations of his memory. Stories of his great feats abound: he could easily remember lists of 70 numbers or words or nonsense syllables and write them on a blackboard in front of an astonished audience. But he had strange habits—sometimes he would imagine erasing the blackboard, then covering it with an opaque film, which he would then strip off the board and crumple up in his fist. Why would he envision such things?

4.The Canadian neurosurgeon Wilder Penfield performed many operations on epileptic patients in which he would remove a small amount of damaged brain tissue, the focus of the seizures. He sometimes stimulated the exposed surface of the brain directly with weak electric currents to pinpoint the damage exactly. In so doing he made some dramatic discoveries about memory. What were they?

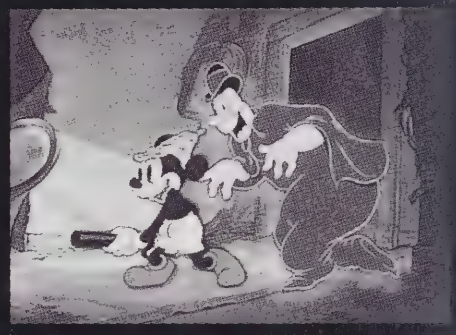
5. On an average winter day, a chickadee will hide several hundred seeds in its home territory, in anything from a cluster of pine needles to a curled-up leaf or a piece of bark. Can these little birds actually remember where these seeds are?

THE ANSWERS

1. By eating each other. The experiments that started this whole story were reported by James McConnell in the early 1960s. He conditioned planaria by the traditional methods of pairing the appearance of a light with an electric shock. Pretty soon the little worms rolled into a ball when faced with the light, instead of stretching towards it as they would normally. Then McConnell chopped up some trained worms and fed them to untrained worms. Sure enough, the cannibals learned to roll up in the light faster than their control partners fed on untrained planaria. The conclusion was that they had ingested a memo-



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ry molecule, and there was even a suggested candidate: the substance RNA, which is closely related to DNA, the genetic material. But these experiments generated tremendous controversy.

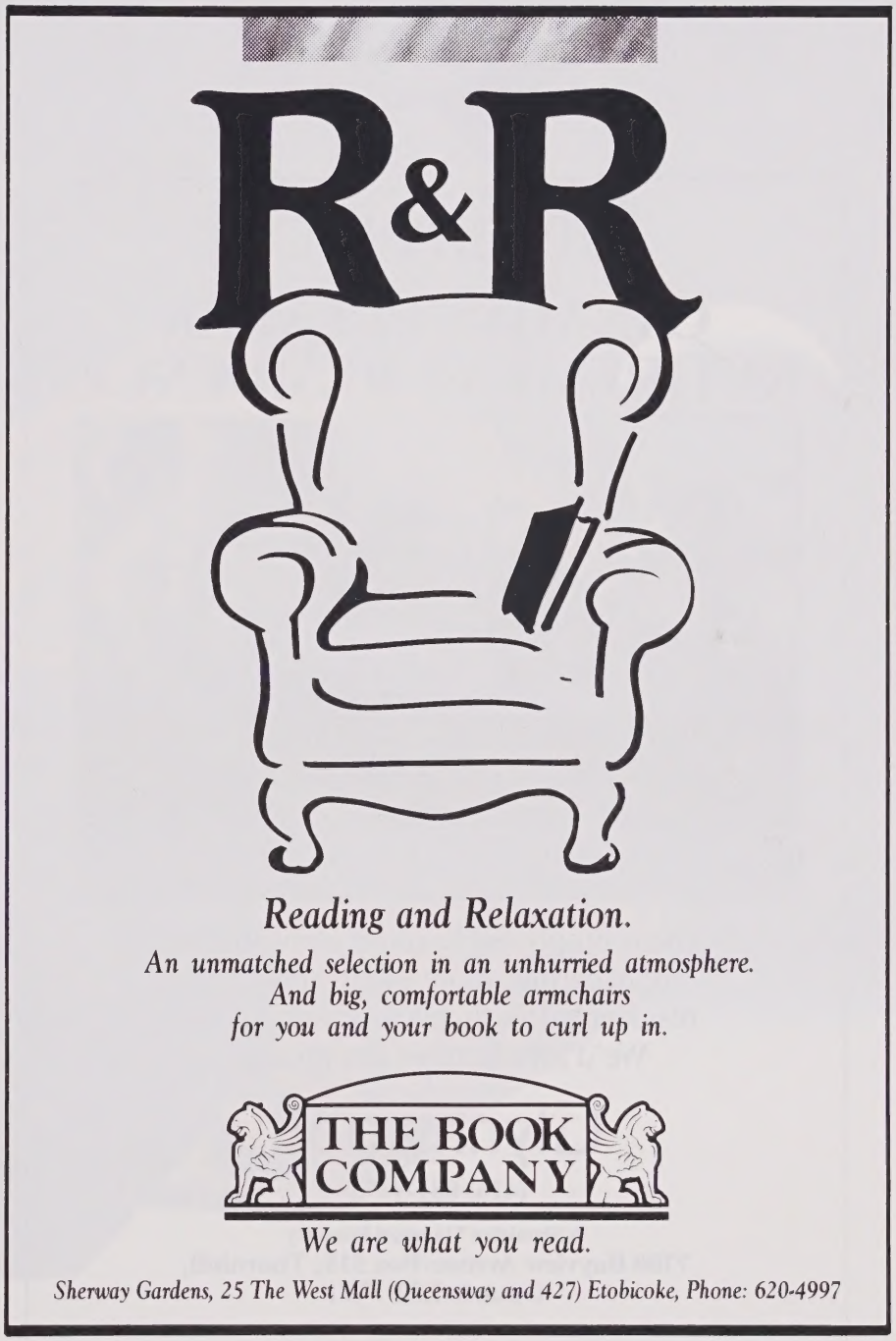
Some critics questioned whether it could even be demonstrated that the little worms could learn. Attempts to replicate the studies either failed, or showed that not only worms, which ate trained worms learned faster; so did worms which consumed their brethren who had just been handled by the experimenters. McConnell's theory is unfashionable today, the belief being that long-term memories are established by strengthening connections between brain cells. But the planaria experiments did leave their mark: the journal begun by McConnell called *The Worm-Runner's Digest.*

2. A few moments later Jimmie had forgotten the entire incident. When Sacks returned to the room, two minutes later, Jimmie greeted him as if they had never met. The alcohol had permanently damaged the structures in the brain that are responsible for transferring memories from short-term to long-term.

A much-quoted case like this is the patient H.M., who in 1953 had an operation to disconnect parts of his brain that were the source of debilitating epileptic seizures. These included the hippocampus and the amygdala, now known to be crucial for memory storage. H.M. remembers everything up to his operation, but nothing since, although he has learned new physical skills like mirror-writing. But while his skills continually improve with practice, he has no conscious memory of ever having performed them before—a convincing illustration that physical skills can be remembered even if events aren't.

The case of an amnesiac patient studied by psychologist Endel Tulving of the University of Toronto reveals another separation of two kinds of memory. This man remembers facts, such as the existence of a family cottage or his former place of work, but he has no memory of being there himself. He knows facts, but remembers nothing of his experience of them.

3. Shereshevky's problem was that he couldn't forget. If he performed several times in the same evening, he was afraid that he might at some point mistakenly write down sets of numbers from a previous performance. So he developed this elaborate mental erasure to prevent that from happening. He finally realized that he had the ability to prevent a previous chart from appearing in his mind's eye simply by not wanting it to. The Soviet neuropsychologist Alexander Luria studied Shereshevsky intensively, and the case has become somewhat controversial. Luria argued that



Shereshevsky's enormously powerful memory was unique, but some researchers claim that people with normal intelligence can train themselves to develop exceptional memories by inventing systems for remembering long lists of numbers or words.

But although there have been cases where an individual who can remember only six or seven digits to begin with has worked up to seventy, Shereshevky's abilities have not yet been duplicated.

4. Simply by touching an electrode to the surface of the brain, Penfield seemingly brought long-lost memories back to these patients, who remained fully conscious during operations. One woman relived the delivery of her baby; another heard a mother calling her little boy, a sound from her childhood. They were eerie and dramatic demonstrations that while we may lose the ability to recall events, especially from long past, they are still stored in our brains, awaiting the right signals to return to consciousness. Or were they? Sceptical psychologists have pointed out that, at most, only a few per cent of Penfield's patients experienced any of these long-lost "memories," and even those that did might have been reconstructing an experience rather than remembering it. The woman who heard the mother calling her little boy thought it had happened in her childhood neighbourhood, but when the same place on her brain was stimulated again, eighteen minutes later, she placed the event in a lumberyard, adding that she had never been in a lumberyard. The jury is still out on whether Penfield's demonstrations prove the existence of permanent memory.

5. Chickadees can remember where they've hidden seeds, although it's not yet clear just how complete that memory is. But it has been demonstrated in experiments carried out at the University of Toronto's Erindale College that chickadees will search preferably in places where they have actually hidden seeds, will avoid those places from which they have already extracted a seed, and even have a good idea where they have hidden sunflower as opposed to safflower seeds. What is amazing is that there is no evidence that they fly a prescribed route, visiting their caches in the same order each time. Such a routine might be a good way to remember, but the birds' food-seeking flight paths appear to be different each time, implying an impressive spatial memory. David Sherry, the psychologist who demonstrated the chickadees' abilities, has also found that their brains house a sizeable hippocampus, the structure that is crucial to the formation of long-term memories in many animals, including man. It is double the size of the hippocampus in birds that don't store seeds.

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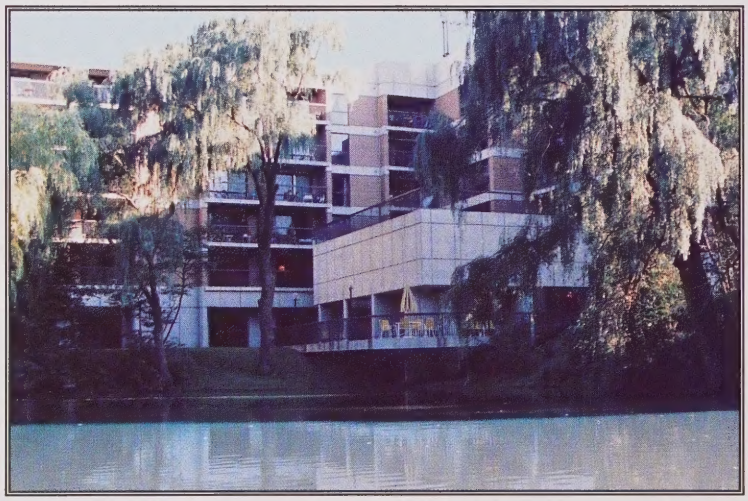

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